TOWARDS A HAPPIER LIFE

OR

The Path to Freedom from Disease

BY

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Madras Medical Service (Retired).

1940

PRINTED AT THE SHARADA PRESS, MANGALORE

FOREWORD

Dr. M. A. Kamath, M. B. & C. M., is a man whose whole life has been characterised by earnestness, energy and breadth of outlook. He has many interests and has studied closely many aspects of life and living. Now his long service ended, in the autumn of his years he has decided to use his pen once more and give his fellowmen the benefit of his ripe knowledge and matured experience. Feeling that two of the essentials to happiness are health and knowledge, a fit body and a balanced mind, Dr. Kamath has developed his theme with characteristic thoroughness so as to help us all "Towards a Happier Life." I trust the volume will achieve the success it deserves and that the aims of its author will be fulfilled.

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Andhra Medical College,
Vizagapatam,
Dated 12th Sept. 1940

AN APPRECIATION

It is a recognised fact that within recent years knowledge in Preventive Medicine has greatly advanced and that increased attention is being paid to this subject in all civilised countries in the world. In India, our people do not lag behind any other nation in the world as regards personal hygiene and are fully aware of the great importance of building up a sound and virile body, but, I am afraid, we do not appreciate much the importance of what I might be permitted to call "Community Hygiene" or hygiene of the people as a whole. This is due to ignorance, apathy and want of correct knowledge of the subject of Hygiene, and it is therefore our urgent need to educate the people, specially the young, in this important subject. Absolutely preventable diseases are taking a very heavy toll in mortality figures every year in India and are in addition undermining the health of many more, so that, instead of being able to earn their own living and maintain their families, become themselves a heavy burden on their families or the nation. This is a heavy and economic loss to our Country and it is our duty to grapple with this problem.

This duty has been amply fulfilled by my friend, Dr. M. A. Kamath, in a comprehensive manner in this treatise "Towards a Happier Life." It is written in simple, instructive language which can be easily understood by laymen. Having had a wide experience in teaching medical students and having been an author of several other medical works, he has been able to bring this mine of

information within reach of all people, and I am sure it would benefit greatly those who study its contents.

I really think that Government should make it compulsory that every High School in the Presidency should have as full or part-time teacher, a well qualified medical man on its staff, and it should be his duty to teach the young minds the contents of this book.

All the various chapters are well conceived and arranged with a view to give full and up-to-date knowledge in each subject and are self-contained. The last chapter (Part Fourth) is a very important one for expectant mothers to prevent Maternal and Infantile mortality which at present in India are absolutely abnormal, and unless checked early by diffusion of full knowledge on the subject would be a standing menace to civilisation and social well-being. This subject should be taught to girl-students in higher forms in all schools.

I am sure the public and specially the coming generation of boys and girls would be greatly benefited by a study of this admirable book and the knowledge garnered would enable them to plant their feet firmly on the road "Towards a Happier Life."

Mangalore
13—9—40

B. Rama Baliga, B. A., M. B. & C. M.
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DEDICATION

TO MY COUNTRYMEN:

The greatest delight of Age and Experience is, it is said, to instruct the youth and to come to the aid of the inexperienced. For, have not we heard of sea-men, unless they be pirates, who had discovered rocks in their voyage and had the good fortune to escape from them alive, pointing out their presence to their inexperienced brethren lest these latter should get ship-wrecked against them in their voyage too? Perhaps no human being worth the name will ever withhold from his fellowmen that knowledge which helps them to avoid the perils of life!

The influence which sound knowledge imbibed in early youth together with the proper conduct of life naturally resulting therefrom, produces on the whole course of man's life is undoubtedly great; for, which man or woman did not repent some part of his or her life-time that he or she did not possess at an earlier age that knowledge on which his or her present happiness depended?

And this work is an attempt to furnish that kind of knowledge to our young men and women, which very few acquire until they are old, when, it may be said, the knowledge has come to them too late to be of real service.

THE AUTHOR

PREFACE

The old idea that disease was a malign influence of Nature or the result of some supernatural action has long been given up, and even from the days of Hippocrates, the Father of Medicine, it had been recognised that the factors which made for health and disease were many and complex, and mainly related to man's environment. Later, with the development of Biology and Bacteriology the entire conception changed, when, it was discovered that man's environment, though it acted as a vehicle for the conveyance of disease or its spread from one individual to another, was not really responsible for it in the first instance, but that man himself was responsible, being the 'reservoir' of disease. It was thus recognised that, while a good and healthy environment was a *sine quo non* or an indispensable condition for good health it was not every thing and that man as an individual has to be considered in connection with his health. Further experience showed that too much attention was paid to ill-health and not enough to health, and hence directed that a general health-programme should aim not only at dealing with disease and its prevention, but at building in the individual a healthy body and a healthy mind from his earliest life, that is, from the time of conception and uterine life (prenatal life) up to the time of death.

This led to the establishment of antenatal clinics—instructions in "mother craft," as it is called—which are now provided in all civilised countries by the State or Private Charities. Here, the expectant mother can obtain expert advice as to her own condition as well as of the unborn baby, and after confinement a work-woman is prevented from attending to her work for 4 or 6 weeks and receives during that period a maternity benefit also.

There is, further, the establishment of Child Welfare Centres and School Medical Services, also maintained by the State or Charities to ensure good health in the growing individual from infancy and childhood.

This is the key-note of modern health policy and methods of providing means of achieving health and preventing disease

in a variety of ways which could not be possible forty years ago, and the purpose of Sanitary Science is to teach people the causes of disease—how to prevent disease, how to live without being sick, how to increase the vital force—how to avoid premature decay. And one of the most useful reforms that can be introduced into Society in these days is that the advice of the Physician should be sought for and paid for, as is the prevalent custom in China, only while in health to "keep the patient well" and not as now, while in sickness to cure disease, which in most cases could be avoided or prevented.

It is mainly with this objective that the following pages are written, also with the hope that our educated readers will derive such benefit therefrom as to help them, and through them the masses, on "Towards a Happier Life."

My thanks are due to my sons Sri. M. V. Kamath, M.B.B.S., D.G.O., and Sri M. Mohan Rao B.Sc. (Agri.) for their help in the preparation of the Book.

Mangalore,
15th June 1940.

M. A. Kamath.

TO THE READER

The main base-work of the book is a number of disjointed lectures given by the Author from time to time at the periodical celebrations of the Health and Baby Weeks in the various places where he served as the Medical Officer; and although the book is intended to be read as a whole each article can be said to be so far complete in itself. As a result of such an arrangement it will be found that we have repeated ourselves on several occasions. We trust, however, that these repetitions will serve as an advantage to the reader than a drawback.

An eminent educationist and kindly friend and critic, who had the goodness to glance the manuscript remarked that the book has been written in a clear and concise manner, but that the general style of expression is rather dogmatic. We admit we had to be dogmatic in some respects for the reason, that the book is meant for the layman and as such, no debatable or moot questions of Science could be raised or discussed about, as such a thing would tend to divert his attention from the main issue. Moreover, the Author's several years' experience in teaching Medical Students has convinced him that the most impressive method of teaching is by being precise and by being dogmatic in one's assertions.

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INTRODUCTION

Why are we so backward in our physical well-being and efficiency as compared with other Nations? Why are we so much eaten up with poverty, ill health and sickness that thousands amidst us die at every visitation of epidemics? Again, while every civilised country in the world has been able to more or less abolish diseases like cholera, plague, small pox and leprosy, and reduced the mortality from tuberculosis, why are these diseases so well rooted in our Country and rampant amongst us? We may naturally say, our poverty is the cause. Well, if we are cursed with grinding poverty which keeps our millions in semi starved condition is it not because our economic condition is bad, our agriculture primitive and our ryots are ignorant of scientific methods of cultivation?

If epidemic diseases like cholera, plague, small pox etc. remain as our permanent guests and carry off thousands every year is it not because we are ignorant of the very elementary laws of hygiene and sanitation?

Now, what are the other Countries of the world doing to improve the health and well-being of their people? We find that the pursuit of health-culture and open-air-life has become a passion, almost a religion in all civilised countries. In fact that was how the open-air-treatment of tuberculosis was started and introduced in all the civilised countries 40 years ago.

Now, what are we doing in this Country to promote national health and efficiency of our people? Prevention is the watchword of this Century and it is our bounden duty to study the sign of the times and march along the path of progress, which Preventive Medicine is beckoning us to follow.

What is our first duty then? Our first duty is to realise the value of health and to regard its preservation as our sacred duty. Now the greatest number of strong and healthy citizens in a nation is its greatest asset, while the greatest number of sick persons its greatest liability. We should, therefore, realise that

if we should live the right kind of life health can be preserved and disease can be prevented. Health is man's heritage and should be as natural as the air he breathes, and God has meant man to be healthy and happy and live to a good old age. Therefore, to the question how we can keep healthy and prevent disease, comes the answer: "We must go to the very foundation, build well our environment and endowment and improve our nurture and nature; good nurture today means good heritage tomorrow. Bring up healthy children today and we shall have healthy citizens in the next generation."

The evils of poverty, of bad feeding, bad housing and bad living, and of certain customs like child marriage, will closely follow us and be felt for generations, unless we go to the very root of these evils and radically change our housing, our feeding our manners of living and our harmful customs, in one word "improve our environments."

There are four cardinal factors which contribute to the efficiency and well being of individuals and nations: (1) Fresh air and sunlight, (2) Good Housing accommodation, (3) Adequate amount of work and exercise and rest, and (4) An adequate and well balanced diet.

"Throw open your house to God's fresh air and sunlight and cultivate the habits of cleanliness,—cleanliness within and cleanliness without,—bring up your children in open-air life and you will drive away sickness" is the advice of Dr. Muthu, the veteran Tuberculosis Specialist. In fact this forms the rationale of the modern .open-air treatment of Tuberculosis.

Country air is certainly much less vitiated, if at all, than town-air. Hence it is that tuberculosis is much more common in towns and congested areas than in villages, and that is the reason also why Sanatoria are always built in country parts and in less congested localities far from the dust and bustle of towns. The value of fresh air cannot be exemplified better than by pointing out the fact, that the staff—medical, nursing and menial—employed in the Tuberculosis Sanatoria are particularly free from the disease, inspite of the fact that they are constantly day and night coming in close contact with tuberculous patients in

all stages of infectivity. Why? Because they live as much in fresh air as the patients themselves. "In fact" says Dr. Muthu "During the 30 years of my sanitorium life in England we never had one single case of typhoid, scarlet fever, diphtheria, cholera plague, small pox or any other infectious disease. Why? because the patients and the staff lived the open-air and hygienic life."

Again, how is it that the European part of our large towns is much healthier and free from disease than the native parts? Because the Europeans live in less congested parts, their streets are cleaner, houses well ventilated, in short, they live in much cleaner surroundings; hence they are able to prevent and resist disease in spite of the extremely enervating effect of the tropical heat to which they do not become easily acclimatised.

Regarding the value of sunlight the Ancients recognised that the Sun was the source of all energy and life, and utilised sunlight and heat to combat disease and keep up health. The Gayatri of the Hindus is only the invocation of Sun-god to remove from man all immoral and undesirable tendencies and mental perversities; and modern science has confirmed this view of the Ancients, viz., the power of sunlight in bringing to normal most of the important harmones or the internal secretions, as they are called, of our body which are so essential for a healthy long life.

It is a well known fact that epidemics of plague, cholera and malaria subside during the hottest part of the year, and show a recrudescence or break out again during the cooler months. Cholera is very common soon after the rains, when drinking water becomes contaminated by the rise in the subsoil water.

One important effect of sunlight is prolongation of life; naturally, when disease is prevented and general vitality or resisting power of the body against disease is increased life should necessarily be prolonged.

A well-balanced diet. More important than fresh air and sanitation is nutrition to build up the body and keep away infection of disease. A well nourished body is the only sure protection against disease. While a well balanced and proper diet is absolutely essential for sound health, endurance and

efficiency, under-nutrition and faulty diet continued for a length of time lead to diseased condition now and degeneration of the race hereafter. If the Indian people are to grow in physical vigour and strength and compete successfully with other nations physically, intellectually and commercially they must reform their dietary, that is, correct their diet deficiencies and make a proper selection of food in accordance with modern ideas of nutrition. A general survey of the dietary habits of mankind brings out prominently one fact, viz., those races whose diet is chiefly carbohydrates like rice and other cereals have the poorest physical development, and those whose diet is rich in proteins and milk and its products develop a high degree of efficiency and endurance. This broad principle finds a splendid illustration in the many Indian races whose difference in their physical efficiency depends more on the character of their food than anything else.

Now, what constitutes a well-balanced diet? The food to be complete and nourishing should contain all the elements necessary to build up the body, especially the proteins, carbo-hydrates, salts of Calcium, Phosphorus and Iron and vitamins.

The diet should be varied and should include milk or its products, eggs, fish, whole wheat flour in preference to the refined white flour, wheat or ragi in preference to rice, leafy vegetables and fruits. Rice is at best a poor food and when milled and polished is still more reduced in its food value and cannot supply the nutritive needs of the body. Milk is the most perfect food for growing children for which there is no efficient substitute. Curds and butter-milk have also certain specific values of their own. This country should produce more and better milch-cows; the dairy industry is a very economic method of producing more food and good food. The wheat should be ground whole so as to include the germ of the outer layers of the grain; which contains fats, proteins, mineral salts and enzymes, which are so essential for digestion and health in general. Brown bread or whole meal bread is, therefore, better and more nutritious article of food than white bread, and the slogan was often heard during the last War that "the whiter the bread the

sooner one is dead." The paddy should be pounded by hand-labour as milling and polishing destroys and separates the pericarp, which contains the nutrient elements like Ca and P salts, which are so essential for the building up of nerves and hardening of bones and teeth.

Beri-beri, a form of muscular paralysis due to affection of nerves is very common among the population accustomed to the use of polished rice. In fact the disease is endemic in some parts of the Northern Circars, where parboiled polished rice is the staple food. The nerves are practically deprived of their nutrition and paralysis is the result. It is a fatal disease death resulting from failure of the heart from the nerves of the heart itself becoming paralysed. A free supply of fresh rice-washings, (not the gruel of boiled rice) does generally improve these cases. In fact this is the main article of food given to beri-beri patients in hospitals and medicine is only of secondary importance. Vegetables should be cooked with just enough of water to prevent scorching, they ahould be "stewed in their own juice", so to say, to retain all the salts, which are necessary to improve our blood. Fresh fruits and fresh greens contain alkaline salts and vitamins which are essential for their cleansing and cooling properties. Their habitual use prevents constipation and the long list of ailments associated with it. Rickets and Scurvy are the two other diseases due to deficiency of salts and vitamins in the dietary. Vitamins, however, at least one of them Vit. C, are apt to be destroyed by cooking or 'tinning" and this is the reason why some advocate the use of a fresh, rather "un-fired" food like salads, nuts and unstewed fruits.

Peas and beans are richer in proteins than the cereal grains, but their proteins are poorer in biological value than the animal proteins, as contained in milk, eggs and meat. The food value of nuts is considerable as most of them are rich in proteins and richer in fat.

Our elders, who formulated our dietary not only from point of health but from consideration of the Trigunas (or triple temperaments) have naturally forbidden the use of animal products except millk and its derivatives, curds and butter or

ghee. Coffee and tea are later introductions into our dietary and are unnecessary, being irritants or stimulants and liable to easily establish habit by their use.

Regarding the use of spirituous liquors, it must be said from a medical stand point that their effects on individual health and on that of the progeny have been uniformly disastrous, not to mention the moral degradation and the economic distress their prolonged use brings about. Nations long addicted to alcohol count perhaps the greatest number of idiots or imbeciles among them, or neurotic individuals whose nervous system is so shattered that they can hardly stand the strain of civilisation, the result being either insanity or suicide. In brief, it may be said that "with an alcholic anything is possible and there is no disease, bodily or mental which alcohol does not predispose to."

With respect to the tobacco habit the effect on the individual or national health and effeciency cannot be better illustrated ihan by quoting the opinion of a French General, who attributed the defeat of his Nation in the battle of 1870 to the prevalence of the smoking habit among the soldiers.

We are in this Century amidst the hustle and bustle of civilisation—whirling and whirring civilisation of cars and planes-- and it is necessary that we cultivate the quality of calm or quiet and restfulness also to ensure a healthy mind in a healthy body; otherwise our body-machinery will break down prematurely and mental equilibrium be disturbed as has been the case in many instances. We, therefore, require a certain number of hours of recreation and sleep. Recreation, it should be noted, is also a form of rest. Growing children and students and businessmen require much more than others. The usual school hours of work should be limited and children should not be allowed to work in the hottest part of the day, as heat also taxes the brain much more than even hard study.

Sedentary life without exercise is not conducive to robust health. Some form of sports and exercise in the open air is necessary for the younger generation and atleast a brisk walk for the older. Exercise and sports not only develop the body but devolop the mind also by fostering team spirit and comradeship

and builds a sports-man-like character. People who in thousands watch football and cricket matches are doing their health more good than they probably realise. There is no tonic among all the hundreds in the Pharmacopia, with such a potent influence on health. People are apt to sneer at those who merely look on as spectators at a play from which they get no actual benefit for themselves, apart from the amusement or excitement. As a matter of fact any change from the daily task and the general stimulation which healthy excitement brings are not to be lightly set aside. They are most important factors in the bracing up of mind and body which is also essential for their healthy growth.

Fresh air, sunlight, nourishing food, good-housing, rest, exercise are, then, the four requisites of good health. They form the four corner stones of the Palace of Health. True civilisation is one that aims at educating and uplifting the fallen brethren in society and if we should earnestly strive to do something every day towards the alleviation of their suffering we can hope to make our Motherland a brighter and happier place for us and the coming generations to live in. And if we should succeed—and there is no reason why we should not when several nations have succeeded—we can confidently hope in course of a few years to build a stalwart and healthy nation, the Indian Nation, of which we may rightly be proud and which will ever stand second to none among the World's nations.

Public Health in India and Government Aid. The Annual Reports of the Public Health Commissioner for India present a true record of the state of public health in this Country and the ways and means adopted by the State towards its improvement, and the latest report, that for 1936 published in September 1938 is typical of its predecessors. A perusal of it shows that since 1931 when the last Census was taken the Country has comparatively been free from violent outbreaks of epidemics, and during the same period the annual balance of Births and Deaths has been consistently favourable to progressive increase of population. During 1936 the number of births was nearly 280,000 higher than that of 1935; on the other hand, says the Report, the number of deaths was less by about 200,000 so that

the estimated population for 1936 showed an increase of about 3,600,000 as compared with that of 1935 and stood at about 282 millions. Between the Census of 1931 and June 1936 the actual increase has been 6.1 p. c. Assuming the same rate of growth during the next 5 years the increase in the population during the decennium,—1931-1941—is, therefore, likely to be something over 11 p. c., or the total population be nearly 400 millions.

Now, the birth rate per mille or every 1000 population based on married female population between 15 and 40 in British India is 212.5. This figure is almost double that of England and Wales, where it is only 112. The high fertility-rate in this country has, therefore, a close bearing on the growth of the population inspite of the fact that mortality-results still remained at a high level. Incidentally, it must be said here, that increased fertility is as a rule characteristic of a half-starved or famine-stricken population and is often met with in Nature both in the case of lower animals and vegetable life. A tuberculous patient, male or female, is very productive, and a dying tree yields most. The object of Nature in these cases is to make the final attempt, an attempt at all costs, to "perpetuate the species." It may, therefore, be presumed that the high fertility rate among our people is in a great measure due to their subnormal nutrition and partly to poverty, child-marriage, improvident marriage etc.

(This colossal increase of population, it will be shown later in these pages, is a very good argument in favour of adoption of the practice of contraception in this Country).

Now, in attempting to assess the general health of the population and estimating the possible trend of events in this Country, consideration should be given to certain important factors, such as the low standard of living of the majority of the people, the large additions of 30 to 40 millions every decade to the population, the high mortality rate, the large amount of labour-inefficiency, disability and blindness brought about by epidemics and other preventable causes, and lastly the question of food production.

The resources of India are, no doubt, immense, but they can become available for the betterment of the people only

through a well-planned organisation of economic development. Agricultural, irrigation and veterinary research, and the application of their results to the problems of the Country are gradually being extended by the Government, and their efforts are already bearing fruit. Large tracts of land have been brought under cultivation, the total area under cultivation of food crops such as cereals being about 200 million acres.

Agricultural Research, for example, has within recent years covered a wide field such as protection of crops from pest and disease, irrigation, fertilisers, soil examination, etc. Also the most important question of co-operation of agricultural and nutritional studies for the improvements of human nutrition is now being actually pursued.

A study has recently been made at the Nutritional Research Institute, Coonoor, by Dr. Aykroid of the food supply and nutritional requirements of the population of the Province of Madras and the conclusion has been reached that the food available is just sufficient to cover the energy-needs of the people provided it is evenly distributed, and that the average diet, which consists mostly of cereals is lacking in animal-proteins, mineral salts and vitamins, which are so essential for the proper physiological functioning of the body. Milk, eggs, fish and meat would supply the required animal protein, whilst green vegetables and fruits provide the essential vitamins and mineral salts. These latter, which have been termed "protective" foods are, however, relatively more expensive than cereals, and ordinarily they are eaten in very small quantities, or are entirely absent from the diet.

These investigations are of particular value in assessing the actual position in regard to the nutritional requirements of the population, which include the provision of adequate quantity of food and of a desirable level of quality; and the same remarks apply equally to most parts of India.

The investigations have also demonstrated a widespread prevalence of conditions associated with the state of subnormal nutrition. Under the circumstances the urgent need at present appears to be the formulation of methods by which the production

of "protective" foods can be greatly increased and their consumption encouraged.

At a joint discussion on "Nutrition in relation to human beings, farm live-stock and crops" held at the Indian Science Congress, Hyderabad on 4th Jannary 1937 with Col. Olver, Animal Husbandry Expert, in the chair, several suggestions were made to improve both the quality and the quantity of the Indian Dietaries.

Colonel Olver, in summing up, said that the main point which appeared to have been clearly brought out was that a larger proportion of "protective" foods of animal origin was essential in order to improve the diet of the people of India. The great importance of an increase in the present consumption of milk had been strongly emphasised by almost every speaker and it seemed clear that far more attention needed to be paid to dairying than had been the case in the past. His own view was that a better balanced system of agriculture was the only feasible way in which a greater and cheaper supply of milk could be secured.

By obtaining the greatest possible return from the land such a system would enable the ryot to make money from milk or ghee and provide better food for his family. At the same time, it would enable him to produce better working bullocks and more and better farm-yard manure, and would increase the return from crops. An increased and cheaper supply of milk and better work animals could thus be produced on every holding of reasonable extent. The feeling of the meeting had in fact been very clear that in order to provide a satisfactory diet for the people of India it was essential to do everything possible to increase and cheapen the supply of milk and dairy products. They also recognised the absolute necessity for keeping the cost of the diet as low as possible but up to the prosent it had not been found possible to replace the protective foods of animal origin by the cheaper vegetable foods Thus skimmed milk was recognised to be the best and cheapest of all foods but he would like also to mention eggs and poultry as valuable source of animal protein. More poultry could easily be kept in every village if properly managed and would cost little to maintain.

since the grain they consumed would otherwise to a large extent be wasted, while there was usually an abundance of the insect life which formed an important part of the diet of poultry.

Only by making the greatest possible use of every available source of foods of animal origin, such as milk and eggs which were of high dietetic value, could the diet of the people of India be made a satisfactory one and the most feasible way of providing such foods seemed to be by mixed farming; but more attention should be paid to subsidiary sources such as fish.

The general poverty of the Indian masses makes it essential to explore every available method which will help to improve the present state of malnutrition. But it should be remembered that diet in India is regulated by custom, tradition and religious sanction, so much so the task of the food-reformer and of the public-health worker is made extremely difficult; efforts should therefore, be made to educate the public in dietetics and the valuable knowledge gained from scientific research in this direction be made available for the welfare of the public. For this purpose, as pointed out above, a concerted effort and co-operation on the part of the public and the Government is necessary.

Recent researches in the Nutritional Institute, Coonoor, have shown that in regard to such an essential article of diet as milk, substitutes such as calcium lactate may be employed, which from the point of view of cost may be well within the means of a very large section of the community, the amount sufficient for a child costing only half-anna per month.

Experiments have also shown that a good supply of Vit A, the deficiency of which in the Indian diet is responsible for much ill-health and malnutrition, can be had in red palm-oil derived from the fruit of a West African palm at one-third of the cost for which it is purchaseable in the form of Cod Liver Oil. A small but successful experiment in the culture of the palm has been carried out in Negapatam in South India. The climatic conditions of certain parts of South India approximate closely to those of Malaya where the palm is grown extensively; and if it can be successfully cultivated in these areas the supply of cheaper vit A

so obtained would be of the greatest advantage to the poorer population of our Country.

Deaths during the year 1936 were nearly 6½ millions. It may be said that throughout India during 1936 conditions were relatively healthy. The death-rate is 23 per mille, i. e. 1000 of the population in 1936 against 22 in the previous year.

The Infantile mortality during 1936 for British India was 162 per mille and the still-births recorded were 21·2 per mille of live-births.

Of 46 countries of the world from which the infantile mortality is available 40 countries recorded in 1935 rates **lower** than that of India, the remaining 5 being Strait-Settlements, Roumania, Chile, Ceylon and Malta. The range of variation in the infantile mortality-rates lay between 32 for New Zealand and 286 for Malta; while nearly half of the 40 countries recorded rates over 50 p. c. **lower than** that of India. This comparison is given to show **how far behind India is** in respect of the measures taken for the protection of infant-lives. Statistics show that about 47 p. c. of the total Infantile mortality in British India takes place within the first month of life. The subsequent periods, 1 to 6 months and 6 to 12 months are relatively less fatal. Infantile mortality during the first month of life is largely dependent on factors influencing antenatal life, particularly so in the case of deaths within the first week. During 1936 the deaths under one week formed 28 p. c. of the total infantile mortality and 60 p. c. of the deaths within one month of age.

This should not cause us any surprise, because as mentioned already, our food is poor, sanitation bad and we are enslaved to certain social customs and habits which drain our vital strength and are dragging us down to the lowest expectation of life. "Expectation of life" is another index of the health and vitality of a people. While it is growing higher and higher year by year in every other country, in India it is growing shorter. E. g. in England it has risen from 49 to 51 and in America from 56 to 58, in New Zealand it has reached the highest and is very nearly 65; even in Japan it is as high as 47, where as in India it has fallen from 25 to 23.

We have already mentioned that "protective" foods are unknown among the vast majority of the population. The poorer section of the population scarcely take any milk. It has been urged by Dr. N. C Wright, D. Sc. that the total supply of milk in India must at least be doubled if the population is to have the "bare-minimum" (equivalent to about 10 ounces a day) necessary for health. Some Municipalities and certain private Bodies have recognised the value of milk as food for growing children and have started supplying free milk to school children with very beneficial results, and it will be an ideal thing if an organised effort will be made to make this compulsary in every school and boarding house. It has been mentioned already that nutrition experts have lately recommended calcium lactate as an effective and cheap substitute for milk, and Red palm oil, a cheap and equally effective stuff containing Vit A in place of the Cod liver oil with its cost and offensive smell.

It is common experience that nations with the largest population have the lowest standards of living. The vicious circle of poverty and large population can only be broken by increased production of food supply and increasing the wealth of the Country. It has been found that the most optimistic estimate of the average income per head per year in India is only Rs. 72, or Rs. 6 a month, that means a little more than 3 Annas per day. Whether it is possible for any one to manage from this paltry daily sum to get his food, his clothing, his children's education, to meet his house rent, medical aid &c apart from his luxuries and pleasures "which make life meaningful" is a matter which can only be imagined and cannot be described. Hence the problem of population and health in India is really the problem of increasing the Country's productive-capacity and income, and a more positive policy of the State to supply free services to the people. We have fortunately at present in all the Indian Provinces a Government pledged to radical social policy and we may hope they will follow a well planned economic policy to raise the general standard of living and also take active steps to improve the sanitary environments of the people. The New Public Health Act lately passed by the Madras Government is a very

important measure containing many useful provisions calculated to advance the public health of this Province; but for the successful working of the Act, or any Act whatsoever, the co-operation of the public with the Government is quite essential.

Maternity Mortality. Maternity, which should normally be a physiological function for the woman attended with little risk to her health or life, claims in India a heavy toll of lives. The total number of deaths from child birth during 1936 in India was 160,000; during 1935 the percentage of women disabled as a result of pregnancy and labour is about 30, which means nearly 300,000 women are temporarily or permanently incapacitated annually taking 10,00,000 as the average annual birth rate. The maternal mortality-rate per 1,000 live-births in India has been estimated to be about 20 in comparison with 3·8 in England and Wales in 1936; and the tragedy lay in the fact that a large number of these deaths, say 80 p c is certainly preventable. Enquiries conducted in Calcutta and Bombay have revealed that anaemia associated with pregnancy and eclampsia are two of the main causes of maternal mortality, and special investigations have been opened by the State concerning them.

India and the Rest of the World. A study of the mortality figures for British India shows that about 49 p. c. of the total mortality in a year is among those people who are ten years of age, whilst the corresponding figure for England is only 12 p. c. During the first year of life India's proportional mortality is about 3½ times that of England. At the next period, between 1 and 5 years, it is five times greater and between 5 and 10 years it is three times as high. About 25 p. c. of the total deaths were among infants under one year, the English figure being about 7 p. c. Another significant fact is that, whilst in England women have lower mortality rates that men at all ages, in India the female death rate exceeds that of the male during there production years, 15—40.

TOWARDS A HAPPIER LIFE

PART ONE

I. Environmental Factors in Health and Disease

It had been recognised even from the days of Hippocrates that the factors which made for health and disease were numerous and complex, such as air, water, soil, sunlight, heat, cold, climate, season etc. But with the discovery of bacteriology and the recognition of the fact that each disease was brought about by a specific bacterium there has been a tendency to divert from all such indirect and complex causes to one of over-simplification. Now, the tide is turning and we realise that very few phenomena in Nature are related to single isolated causes; we recognise, for example, that the predisposing factor in a case of Tuberculosis is more often a lowered vital resistence than the mere entrance into the system of the Tubercle bacillus; we understand that the season of the year is as essential a factor in favouring the prevalence of pneumonia as the presence of the causative microbe itself. In short, we recognise the importance of the physical environment upon health and disease; and the atmospheric envelope which surrounds us everywhere is one of the most important elements in this environment.

It is common knowledge that the general death-rate in temperate climates shows two regular seasonal maxima or 'peaks,' in late summer and in late winter. Two distinct groups of diseases are chiefly responsible for these peaks—the warm weather group of diseases like infectious diseases, cholera, typhoid, yellow fever and malaria, and the other, the cold weather group, like pneumonia, bronchitis, tuberculosis, diphtheria, rheumatism etc.

Geographically also we find practically the same general difference in incidence—the summer diseases of the temperate climates being also diseases of the warmer regions and the winter diseases being mostly prevalent in colder climates. In general it may be said, then, that intestinal affections are more prevalent in warm weather and respiratory affections more prevalent in winter; and physiologists have explained the phenomena by assuming that in summer the blood is largely in the superficial parts of the body and the resistence of the intestinal walls is lowered by the consequent condition of anaemia; while in winter, physiologists say, the blood is in the internal organs, and the mucous membrane of the nose and the upper respiratory passages shows a similar lessened resistence as a result.

In some instances season and climate favour the spread of the transmitting agents also as in the case of insect-borne affections.

The effects of environments on disease-mortality are by no means purely seasonal in charactor. They are related to weather as well as to climate and season. We find, for example, that the death-rate from pneumonia is not only higher in the cold month January than in the warm month, June, but is also higher (on the average through a period of years) in cold Januaries than in warm Januaries. Nearly 300 persons are reported to have died of Pneumonia in the Punjab in the first week of January 1940, the abnormal rise in the death-rate being attributed to the severest winter experienced within the last 11 years.

Diarrhoeal diseases of infants do also respond very directly and sensitively to the daily and weekly variations in temperature during the summer months. In fact, a climate which exhibits moderate variations in temperature is more favourable for health than one which is even and unchangeable.

Huntingdon, who has contributed many stimulating ideas to the discussion of effects of climate says that aside from biological inheritance the main factors in determining the health of a people are climate, food, parasitic diseases and the stage of culture; and that those areas of the Earth's surface which possess a cool, fairly moist and moderately changeable climate

are precisely those where human civilisation has reached its fullest and richest development. Constant and equable climates, on the other hand, especially when warm and humid tend to produce a weak and languid race of men.

Moist climates are undoubtedly less healthy than dry ones. Decomposition is only possible in the presence of moisture in the air or in the soil, and microbes multiply more rapidly and are more abundant in moist air than in dry air. Evaporation from the skin and the lungs and the capacity for exertion are also decreased by excessive humidity of the air.

I. Air and Ventilation

We saw that the most essential factor in human environment is air, and man or animals can be deprived of food and water for some hours or days but life demands a continual supply of pure air. Pure air is, then, a great necessity of life and perfect health can only be maintained if there is an abundant supply of pure air in addition, of course, to the other requisites of life; and ill health is largely the result of constant breathing of a vitiated atmosphere. Thus is explained the generally lowered vitality and the increased tendency to diseases like Rickets, Anaemia and Tuberculosis among the dwellers in the slums of our large towns.

Air is a mechanical mixture and has practically a constant composition, which is maintained by the diffusive property of gases and movements of air currents and the reciprocal action of animals and plants on air. The average composition of atmospheric air is as follows:

Oxygen—20.9 Vol p. c.
Nitrogen—78.1 ,,
Carbonic acid—0.03 Vol p. c.
Argon—0.89 ,,
Water Vapour—Variable with the Temperature.
Ammonia—Variable.
Ozone and Mineral matter—trace.
Suspended matter—Variable.

Oxygen (O) is the principal agent in supporting life and

combustion; Nitrogen acts as a diluent and modifies the activity of the Oxygen;Ozone(O_3, known popularly as condensed oxygen) is found in very minute quantities if at all in town-air and results from electric discharges into the air during a thunderstorm and during evaporation by the sun of large quantity of water. Hence ozonised air is more abundant on the seashore. Ozone in contact with decomposing organic matter yeilds up its extra atom of Oxygen and this property makes it of special value from a hygienic point of view; for, by this action it renders certain dangerous organic effluvia innocuous or harmless.

Carbonic Acid(CO_2). The chief source of this is the respired air of animals and human beings, combustion of fuel, decomposing animal and vegetable matter and volcanic phenomena; and along with its production there are means, such as the action of plants, for its removal from the air. The amount of Carbonic acid present in the air is subject to slight fluctuation. It is increased by oxidation and decomposition of organic matter, chemical action in the soil, and respiration of animals; it is decreased by vegetation and currents of wind and rain, and in rooms by proper heating and ventilation. CO_2 is said to be absent in desert air.

The percentage of CO_2 in inhabited rooms is about 0.04 p. c. and when this limit is exceeded it should be considered as impurity. The amount of CO_2 found in the air of large cities is large, as much as .05 p.c. This is due to combustion and certain industrial processes. Ammonia and its salts are present in the air in small quantities. The amount of NH_3 present is an indication of the decomposition of animal matter taking place on the surface. Rain dissolves ammonia and hence its amount in the air diminishes after rain. In fact rain removes most of the dust and impurities from the air.

Organic and suspended matters consist of minute particles of mineral matter, common salt especially near the sea, dust, soot, bacteria, hair, vegetable debris etc.

The amount of moisture present in air depends upon the surrounding temperature. There is more watery vapour in the air in the Tropics than in temperate and cold climates, more at

sea than on land, more in summer than in winter. The amount of moisture present in the air has an important influence on health both directly and indirectly. The evaporation of the moisture from the skin is the great regulator of the temperature of the body, and if the quantity of watery vapour in the atmosphere is great, evaporation is interfered with and the effect of heat is more felt.

We have seen that the impurities of the atmosphere are derived from products of respiration and of combustion, from smoke, dust and bacteria and industrial processes.

Impurities from Respiration

An adult gives out at each respiration about 30.5 cubic inches of air. The proportion of gases present in **Inspired** and **Expired air** is thus represented:

	Inspired Air	**Expired Air**
Oxygen	20.96 p.c.	16.40 p.c.
Nitrogen	79.0 ,,	79.19 ,,
CO_2	.03 ,,	4.41 ,,

Hence Expired air contains 4 to 5 p. c. less oxygen and 4 p.c. more CO_2 than inspired air or the air of atmosphere.

Expired air also contains organic poisons, large amount of heat and moisture; and the ill effects felt in confined and crowded rooms were once attributed to the diminution of O, excess of CO_2 and presence of organic poisons in the expired air; and very little attention was paid to the variation of the temperature, movements of the air and the amount of watery vapour contained in the atmosphere.

So until about 50 years ago the problem of ventilation was generally considered to be a matter of maintaining the proper percentage of O and CO_2 in our indoor atmosphere; and Herman pointed out in 1883 that the symptoms of discomfort like restlessness, mental sluggishness, dull headache etc. often felt in an overcrowded poorly ventilated room were due not so much to the lack of O and the excess of CO_2, nor to the organic impurities in the expired breath as to an excess of heat and moisture. In other words, it is the physical rather than the

chemical properties of the expired air that are responsible for the ill effects in a closed and ill ventilated room.

That CO_2 excess is not the cause of ill effects is proved by the fact that in breweries where there is an excess of CO_2 present in the fermentation rooms several workers are confined during the day without feeling the ill effects of the excess of CO_2. CO_2 can, therefore, be said to have little to do with the evil effects of a confined atmosphere.

The belief in the existence of organic poisons exhaled by breath and skin cannot be substantiated. The foul odours of ill ventilated and crowded rooms arise from foul breath from pyorrhoea, caries of teeth, tobacco smoke, from dyspepsia, from the decomposition of food particles in the mouth, from gases in the alimentary canal and dirty clothes soiled with the discharges from the body. Although odours of themselves may be harmless good sanitary condition implies that houses, clothing and bodies of persons should be clean and free from suffocating and offensive odours.

Watery Vapour. This is always present in the atmospheric air however dry it may be. Its amount, however, varies with the temperature and the amount of fluid present from which the evaporation can take place. The humidity of a room also depends upon the number of persons occupying the room as a large quantity of water is given out by the lungs during respiration and by the skin as sweat.

Watery vapour being a product of combustion of coal or coalgas these also contribute to the moisture in an inhabited room. Excessive moisture in the air is an important factor in certain industries also.

It is common experience that the effect of a current of cool air on our bodies especially the face is very exhilerating and stimulating, it aids digestion and absorption of food. The stimulant effect on our system of a brisk morning walk is thus explained. A sufficiency, therefore, of cool, moving, dry air is necessary and is conducive to good health and a feeling of comfort and wellbeing. Combined with such air there must be a sufficiency of sunlight also. The effect of sunlight on the body

is, as will be pointed out later, briefly this: Our skin can absorb the ultraviolet rays from the Sun and utilise them for the manufacture of Vit. D, which vitamin will be seen to be chiefly concerned in the utilisation of Ca and P from our food and prevention of rickets.

Products of Combustion and Lighting. Impurities due to combustion are chiefly derived from coal used as fuel. During combustion coal gas gives off CO and CO_2 in variable quantities and also small quantities of Sulphur and Sulphuric acids, CS_2. H_2S, soot and smoke. There is also a corresponding decrease of O from the air.

Artificial lighting also gives rise to impurities in the air. Coalgas is by itself poisonous when inhaled and produces a large quantity of CO, CO_2, CH_3 &c. by combustion. It is estimated that an ordinary gas-burner vitiates as much as 7200 cubic feet of air in one hour, that is, as much as 3 adults do by breathing for one hour. Kerosine oil, Cocoanut oil and other oils on burning do give out a large amount of CO_2 and smoke; moreover, all artificial lighting raise the temperature and increase the humidity of the room, abstract oxygen from the air and add CO, CO_2, ammonia, soot and smoke to the air.

Electricity is, therefore, the best source of lighting from a sanitary point of view, for not being dependent on the O of the air it does not vitiate the atmosphere and does not materially raise the temperature of the room.

Smoke. Ordinary smoke consists of unburned carbon particles, hydrocarbons and other pyroligneous bodies containing acids, poisonous and irritating gases etc., and few people realise the extent of the damage to property caused by smoke and the seriousness of the menace it holds out to public health. A smoky atmosphere directly irritates the eyes and the upper respiratory passages and increases the mortality from pulmonary (lung) diseases; and both smoke and soot predispose to pulmonary tuberculosis. A smoky atmosphere is a source of dirt, shuts out light and the ultraviolet rays of the Sun and prevents the entrance of fresh air.

"Smoke corrodes the mental and physical equipment of

those who cannot escape from it to a purer atmosphere." Smoke also injures vegetation both by mechanically choking their respiratory mechanism and by the action of certain acids.

The menace to public health from an atmosphere laden with smoke from chimneys in the industrial cities especially of countries not amply supplied with sunlight is a serious matter, as statistical evidence shows a close relationship between death rates from diseases of the Lungs and the Heart and the intensity and duration of smokefogs. Not less serious are the indirect effects due to obstruction of solar radiation, and dwellers in towns are as a rule stunted because of the ultraviolet radiation not being sufficient to produce proper assimilation of Ca and P. While effects on the body are bad those on the mind are worse. "Smoke gloom lessened the potential reserve, working power and well being of the individual. It increased fatigue, irritability and restlessness,—gloom without made for gloom within and induced mental depression' —says an eminent authority on Public Health.

Atmospheric pollution is, however, not a serious matter in India as we have abundance of the tropical sunlight, which exerts its clarifying effects through the agency of vegetation, which, as a rule, grows luxuriantly in our Country.

Dust and Bacteria. In addition to the normal and universal constituents of the atmosphere there are usually present in greater or less amount suspended particles of organic and inorganic dust; and among such suspended particles are living microbes of various sorts. Dust forms an important impurity in the atmosphere of the Tropics. Scales of epithelium, fibres of cotton, linen and wool, hair particles, dried sputum and particles of excreta etc. are found in inhabited but imperfectly ventilated rooms. Ordinary street dust contains soot, decaying leaves and manure, fragments of insects, their eggs and bacteria. Street dust may, therefore, contaminate food if it is kept exposed for sale without proper protection.

The bacteria are carried about in the dust and the great source of bacteria in the air is the soil, which is teeming with micro-organisms. On windy days and in dry weather the air

always contains more bacteria than at other times. The bacteria contained in the air are also derived from all collections of dust and dirt from rooms and other inhabited places of any kind. Of the dust which may be collected from floors and other surfaces the amount which actually gets into the atmosphere is after all very small except when the dust is stirred up by sweeping or by violent winds or beating of dusty carpets.

The common method of dusting articles and furniture adopted by most servants simply disturbs the dust and sets it in motion rendering the atmosphere irritating to the nostrils.

Although the microbes contained in the air are considerable in number they are, as a rule, harmless; but specific disease-germs, such as of Tuberculosis, Typhoid etc have been isolated from the air of crowded rooms.

Large quantity of dust even free from bacteria undoubtedly irritates the mucous membrane of the nose and the respiratory passages, and lowers their resistence to infections such as Colds, Influenza, Pneumonia etc. and when in addition we consider that analysis of indoor dust often reveals a large number of bacteria we do not have to look far to explain the attacks of influenza (grippe) to which we often fall a prey. Frequent breathing of dusty air renders one liable to Sore throat, Chronic Bronchitis and Asthma with predisposition to Tubercle of the lung.

The number of bacteria contained in the atmosphere depends upon local conditions. Few are present in high mountains, at sea and deserts; they are less in the open country but most in the air of cities and crowded places.

During normal breathing the expired air does not contain any bacteria as the wet mucous membrane of the nose and the upper air passages arrest most of them during the passage of the air along it.

When a person coughs or sneezes or talks, however, the fluid contents of the mouth and nose are sprayed into the air in minute ''droplets'' and these may contain the germs of any infection that may be present in the mouth or respiratory organs.

Clean fresh air should be considered as important as clean water and the only way of supplying it is by flooding the

rooms with abundance of fresh air.

Sewer Air contains gases due to decomposition of organic matter and are apt to produce, when inhaled constantly, general ill health and lowering of the resistance power of the body to disease, and predisposes to septic sore throat, Diphtheria etc.

Industrial Impurities These consist mostly of acids and alkalies, H_2S, CO, CO_2, organic vapours and fumes of zinc, arsenic, phosphorus and carbon di-sulphide (CS_2).

CO is a very real menace wherever imperfect combustion is taking place. Amongst garage-workers chronic poisoning by CO is common and deaths are common enough among operators of motor vehicles when the engine is run in closed spaces; and even in the private homes the use of badly designed gas-heaters have caused fatalities from CO poisoning. Other industrial impurities are all irritants and if constantly breathed irritate the mucous membrane of the throat and the bronchi predisposing them to the attacks of Influenza, Asthma, Sorethroat, Bronchitis and Pneumonia.

Certain forms of industries like coal-mining, metal-mining, granite-working, knife-grinding and polishing etc. are liable to give rise to dust of varying kind, and the constant inhalation of any inorganic dust produces fibrotic changes in the lungs (pneumokoniosis or knife-grinder's phthisis) increasing the susceptibility to acute respiratory diseases like Bronchitis and Broncho pneumonia and even Pulmonary tuberculosis.

Prevention of Dust Nuisance. Home dust is kept down by avoiding dry-dusting and ensuring efficient ventilation. Sweeping should be done by the use of vacuum-cleaners or by wet-mops. Use of matting for floors favours collection of dust and should be avoided.

Dust from outside is too often blown into the house. This is prevented by properly screened windows, and use of glass shutters.

Street dust is very difficult to prevent and perhaps hopelessly impossible in the Tropics. Roads should be well constructed with a good surface, they require regular watering or oiling. Tar-macadamised roads are an improvement and

have considerably minimised dust nuisance. But statistical evidence has shown that the tarry matter from roads is atleast partly responsible for the production of cancer of the lung from prolonged inhalation.

Ventilation

We have seen that a sufficiency of cool dry moving air combined with a sufficiency of sunlight is necessary for good health and wellbeing. To give such light and air under conditions of ordinary life constitutes the problem of ventilation. We should, therefore, have our houses so built as to permit free current of air passing through the house.

In the hot weather when even the slightest breeze is a source of comfort there is usually some prevailing direction from which the wind blows; and our houses should be built facing the direction of the winds, so that the breeze may enter the house from the wind-side and pass straight out at the other. This action of the wind is called "perflation" and is our most natural and efficient means of ventilation as the hot moisture-laden and impure air is thereby blown away and is replaced by a cooler and drier air from outside.

A "through" ventilation may be secured in our houses by having the windows facing the prevailing winds especially with regard to the hot weather and placing the windows and doors directly opposite each other.

The action of fans is practically the same, they push away the hot moist layer of air around our bodies and thus allow loss of heat to go on much quicker.

Beneficial effects of fans are more felt when the discomfort is due to the sweat from our skin not being evaporated, and then a sense of cooling results when the fans are put on. But when the sense of discomfort is the result of a hot air around us, so hot that it will not take any heat from the body, but rather gives more heat to it, then little relief is obtained from a hot current of air. In such cases the air has to be cooled by such means as a thermantidote or the use of Khuskhus-grass thatties hung up in front of the room and kept moist with water. The wind

passing through the moist thatties gets cooled and so cools the room. These thatties are, as a rule, useful in hot dry places.

Various standards have been fixed to ensure that the air in a room is kept suitable in heat and moisture. 1000 cubic feet are considered desirable for an individual giving a floor area of 100 square feet. This standard is applicable to rooms constantly occupied, like barracks etc. Expense and other considerations may necessitate a smaller allowance, but 40 sq. ft. of floor area per individual should be the minimum.

Now, we have seen that there are several diseases carried by "droplet infection." Such are the common Cold, Influenza, Diphtheria, Tuberculosis of the lungs and Epidemic Cerebro-Spinal Meningitis, Measles and Scarlet fever; and these "droplets" contain their causative germs. The only feasible means of preventing the spread or limiting the spread of these diseases is by "spacing out" our people so that they are not likely to come into close contact with others. In hostels and barracks it is advisable not to allow the beds to be nearer than 6 feet, and even this, they say, is near enough. It is, therefore, advised that crowded cinemas and indoor shows should be avoided during the prevalence of epidemics of these diseases.

Ventilation of dwelling houses and rooms is known as "Internal" ventilation. But in the case of the general air-space of towns advantage is taken of the natural means of purification of air. This is done by having the streets broad, buildings moderately high and not very close to one another so as not to obstruct free circulation of air but admit enough of sunlight during the major part of the day. This "external" ventilation is of primary importance to internal ventilation, for upon the purity or otherwise of the outside air depends the possibility of good internal ventilation. In this connection must be mentioned the evils of the "purdha" system prevalent mostly among Moslem Women. This favours overcrowding, want of fresh air and want of sunlight. Living in dark dingy places day by day impoverishes the body, lowers the vital strength and weakens the resisting power of the body to diseases like Tuberculosis, Rickets, Anaemia etc.

Now, efficient external ventilation may be ensured by preventing impurities from our surroundings as by watering the roads, by careful inspection of drains and sewers, by the speedy removal of street and other refuse and by locating the industrial plants outside the crowded areas etc.

Provision of open air spaces and parks is very useful towards minimising congestion and over crowding.

The Art of Breathing

Man's nasal passages are provided with a delicate hairy lining, the function of which is to warm and filter the air breathed through them, before it reaches the lungs. Thus, the air passing through the nasal passages and through their lining is not only warmed but its impurities, like noxious vapours, dust and bacteria are all eliminated. Hence it is advised that the habit of normal breathing, that is, breathing through the nostrils with the mouth shut, should be cultivated even from childhood; and mothers should see that the children are taught to breathe from the very childhood through the nostrils and not through the mouth, as mouth-breathing is a very dangerous habit, which does not obtain even among animals; and it specially predisposes to diseases like Asthma, Bronchitis and even Tuberculosis of the lungs.

Apart from wrong habit the condition of mouth-breathing is indicative of presence of adenoids. Adenoids are a collection of lymphoid tissue in the roof of the naso-pharynx met with in children. They mechanically prevent breathing through the nose and necessitate the child to breathe with the mouth wide open.

Now, the location of the adenoids at the portal of entry to both the lungs and the digestive tract subjects them to many irritants in the form of dust, bacteria and sudden currents of cold or damp air. Changeable atmospheric conditions undoubtedly have an unfavourable effect on the nasal mucous membrane and the upper respiratory passages such as the pharynx and the bronchi and predispose the child to severe attacks of Acute Infectious Diseases. Ear affections are very common among such.

children. Constant difficulty encountered in forcing air through the nose and the naso-pharynx forces the child not only to use the mouth for breathing but gives rise to a condition known as "the adenoid face" (also known as the Frog-face), characterised by open mouth, stupid expression, narrow high-arched palate and crowded teeth. Mouth-breathing may produce certain indirect effects also, such as changes in the facial expression, retardation of bodily and mental development, defective speech, deafness and also numerous symptoms which go by the name of "reflex neuroses"; among these can be mentioned night terrors, tetany, epileptiform convulsions, paroxysmal night attacks of croup and coughing and occasionally night enuresis (passing urine in sleep). Snoring in sleep is due to both obstruction to breathing and the narrow arched condition of the palate.

The incomplete aeration of the lungs from defective breathing predisposes them specially to attacks of Tuberculosis.

Deep Breathing. We have many advocates of deep breathing to ensure health and cure a great variety of human ills; and often abundant claims are made by them as to the beneficial results of the practice of deep breathing. But experience has taught that forced breathing of any kind is unscientific and unphysiological for the reason that oxygen cannot be stored up in the body, as the need of the O to the tissues depends only on the needs of the body cells, and voluntary taking in Oxygen regardless of the body needs is irrational.

Breathing exercises to increase the size of the lungs and chest unless used for correcting certain definite conditions or defects of the body are unscientific and dangerous. That deep breathing prevents Tuberculosis is not established; so the evi s aimed to be corrected by breathing exercises had better be corrected by properly prescribed physical exercises adapted to the needs of the **entire** body.

2. Climate

The effects of a tropical climate on the human constitution is mainly an enervating one especially in those whose constitution

has run down from alcoholism, malaria, dysentery or sprue. Now, man being a warm blooded animal his body temperature adjusts itself to the normal level of 98.4°F irrespective of the surrounding temperature. His body produces heat by the contraction of his muscles during exercise and even while at rest; for, even at rest there is a certain amount of contraction of muscles known as "the muscle-tone." Certain chemical changes occurring in the tissues of the body, the digestion of food, breathing etc. do all produce a certain amount of heat. Heat may be absorbed into the body from outside from Sun's rays.

Any excess of heat in the body is lost by increased respiration and by perspiration, by conduction to the outside atmosphere and by evaporation from the surface of the skin. If the heat is lost too quickly we feel chill, which is an important factor in reducing the power of the body cells to withstand the action of disease microbes.

If heat cannot leave the body at a sufficiently high rate to keep the body temperature at the normal level of 98.°4F or thereabouts a condition of "heat-stagnation" results and the body temperature rises. If there is no relief obtained the heart and respiration—Centres in the Brain become disturbed, unconsciousness supervenes and the person eventually dies of heart and respiration failure. This condition is known as "heat-stroke"; which may occur anywhere, but is particularly prone to occur in the tropics, where the surrounding air, especially if it is moist can take up very little heat and moisture from our body. The discomfort with headache, nausea and perhaps vomiting as we generally experience in confined rooms and over-crowded buildings is due to heat stagnation. Over-crowding and bad ventilation perhaps explains the tragedy which occurred at Tirur during the Malabar Rebellion of 1921, when several of the Moplah prisoners were huddled together on a hot afternoon in a railway horse waggon with closed doors, the only means of ventilation being the wire-gauge-protected windows, the meshes of which were clogged with paint and dirt. Although most of the deaths were due to asphyxia (or suffocation) the element of the effect of the heat of the day has played a great part in the causation of death.

as most of them who were alive at the time of opening the door of the waggon had complained of intense thirst and asked for water.

Dr. Leonard Hill recorded that in the Black Hole of Calcutta and similar notorious cases death occurred not from suffocation as was generally supposed but from heat stroke.

[The Black Hole of Calcutta is after all according to later Historians only a myth].

It is doubtful whether there is such a definite or separate condition as sunstroke **(Coup de Soleil)** supposed to be due to the effect of the actinic rays of the Sun on the individual, as the actinic rays penetrate only a small distance into the skin. Sir Victor Horsley held the opinion that heat-stroke and Sunstroke were always due to some form of alcoholism, and it is generally recognised that alcoholism makes a person particularly prone to heat-exhaustion. So also over-work and fatigue. Cerebral type of malaria produces symptoms similar to heat-stroke and the common prevalence of this type of malaria in the Tropics should be borne in mind.

Thus, tropical climate *per se* has few if any deleterious effects on the human organism, and if a person is of regular habits and be moderate in his food and drink his health will ordinarily remain good in the Tropics. In the case of new comers from the more temperate regions provided they remain free from disease and are also careful about their habits, food and drink they soon become acclimatised to the new climate. This power of the human organism to readily adjust itself to altered conditions of environment has made the colonisation of the Tropical Zones by the white races possible.

We said that if the heat of the body is lost too quickly chill is produced, to get over which or to increase the production of body heat the individual contracts all his muscles as is seen in "shivering." Shivering is, therefore, a natural protection against cold.

Hill-Climates

The atmospheric pressure at the Sea-level is equal to 30 inches of Hg (mercury) or a weight of 15 lbs. to one square inch

of surface. As we ascend above the Sea-level the pressure diminishes. Thus, at Bangalore, 3,500 feet above Sea-level, the pressure is equal to 27.7 inches Hg, and at Ooty (7000 feet above Sea-level) it is about 23.6 inches. Small changes in pressure may be observed in any one place, but they have no perceptible effect on health.

The physiological effects of high altitudes by reason of considerably lowered atmospheric pressure is to increase the rate and depth of respiration and the pulse; but no harmful results are ordinarily produced until an altitude of about 10,000 feet above Sea-level is reached.

In addition to the decreased atmospheric pressure other factors should be taken into account in considering the effect of high altitudes on health. The climate of high altitudes is cold, because the temperature becomes lower as we ascend higher, and the air is often very dry due to proper drainage of the soil, rapid evaporation and free movement of air; and impurities of all kinds including micro-organisms rapidly diminish as we go higher and higher above Sea-level. These factors combined with increased exercise or activity possible in a cool climate do contribute largely to the healthiness of hill-stations.

Climato-therapy

We have seen in the foregoing pages that loss of heat from the body is mainly influenced by the temperature, humidity and movement of the surrounding air and also the freedom of access of air to the surface of the body. These are also the factors which influence the condition of the mucous membrane of the respiratory passages. Hence it may be said that the effects of climate on the body, apart from those of Sunshine, are directly proportional to the time spent in the open air and the extent the body is kept exposed to the movement of air. Young persons and well nourished persons will often respond favourably to life out of doors in the dry cold climate of high altitudes even though a greater amount of clothing is necessary and only a small part of the body surface can be exposed to the moving air. But older people and people poorly nourished are

compelled to seek the drier and warmer regions, where they can live comfortably out of doors in minimum clothing in the day time and a small amount of bed clothing at night. The maximum effect of climate is obtained when living comfortably out of doors all the 24 hours of the day in a moving, cool, dry atmosphere in as little clothing as possible.

In diseases in which loss of heat by evaporation of sweat is desirable warm dry climate will prove beneficial.

Change of Air

(See also Spa treatment or Balneology—later)

A change of climate will often in itself have a favourable effect on a patient's mental attitude and physical condition. The fact that he is making "the change" for the express purpose of benefiting his health will frequently arouse in him a more intense desire to co-operate with his medical adviser and to a greater expectancy of a favourable result, change of environment especially to one where other patients with similar complaints have been known to have already been benefited or to have recovered, with its attendant atmosphere of hopefulness and expectancy has a very beneficial effect. All this effect is in addition to the change in the physical condition of the surrounding air causing "new stimuli to the nerve cells" of the body.

In this connection it must be said that real climato-therapy plays only a very small part in the treatment, and it is usually futile to send a patient to a more favourable climate if by so doing he is deprived of proper food, care and expert medical supervision, as between care and climate the latter should always be a secondary consideration. In the least favourable climate good care provided the surroundings are the best obtainable will produce much better results than the best known climate but without proper care. If the patient has to choose between care and climate he should choose the care rather than the climate, but if he is fortunate enough to have both his prospects of recovery are doubly ensured.

Sea-air and Sea-bathing

Sea-water contains about 3% Sodium Chloride as well as Sulphates of Magnesium and Sodium together with the Salts of Iodine and Bromine. Sea-air contains a high proportion of water vapour, but the unpleasant effects of this rather high humidity is counter-acted to a great extent by the cool moving air. Apart from the obvious change of environment and better hygiene of the Sea-shore the beneficial effects of Sea-air and Sea-baths are largely due to increased activity of the skin consequent on the movements of air as well as to the direct ultraviolet light and that reflecting from the surface of the water, and the effect of the Sea-water itself.

3. Water Supplies and their Protection

Among all the problems of sanitation that of a pure water supply stands foremost and even the earliest organised life of man centred round a spring or river which made possible the establishment of a permanent settlement, and the River-gods were, therefore, the most ancient and honoured dieties of mythology.

The original source of all water supplies is rain, formed from water distilled by sunlight from the surface of land or sea, from the leaves of plants and bodies of animals; and as the rain falls through the atmosphere it absorbs various gases and washes the atmosphere free of inorganic and organic impurities, giving the brilliant clear air familiar to us after a heavy shower.

From a sanitary point the rain before it reaches the earth is, however, of a high degree of purity containing only an infinitesimal fraction of suspended and dissolved material and is practically free from microbes, at any rate disease-producing microbes. But it is when the rain actually strikes the surface of the earth, the cultivated fields, farm yards, unclean streets of the towns and dump heaps that the water changes its characteristics as it sweeps along in its course suspended material, dissolved material and bacteria, among which in places of human habitations intestinal bacteria and ova of worms are almost sure

to be present. Such a water is luckily turbid, and this is a clear indication of its unwholesomeness, which means that it should not be used for human consumption.

Part of the rain-fall becomes "the surface" water flowing off in the rivers and lakes and ultimately to the sea; other part of the ground water sinks into the subsoil and finds its way slowly by an underground route to the bed of the nearest stream. It is this sub-soil water that we tap when we drive a well or when we find the water of a spring gushing from the side of a hill whose slope has cut through a water-bearing stratum.

In seeking for the water supply of a town we may turn either to surface or to ground-water sources. Surface waters are obtained either from natural reservoirs of lakes or artificial reservoirs formed by damming a stream flowing through a suitable valley; ground water supplies may be obtained from springs or wells or filter-galleries; these last are really large wells dug out near the bank of a river to intercept the ground-water flowing through the soil towards the river-bed.

While the water of a running stream is more or less exposed to fresh pollution from its banks it is at times of heavy rains or melting snow that surface waters get the most dangerous pollution. So constant is this phenomenon that the seasonal prevalence of epidemics of Infantile diarrhoea, cholera or tyhoid fever is a reasonably clear indication of the part played by water supplies in the causation of disease. Great care should, therefore, be taken in choosing a clean source of water-supply and in protecting the water from contamination before it reaches the consumers. The most dangerous contamination is from sewage and human excreta, other sources being from animals and from the disposal of waste water from houses and factories. Hence, surface water from cultivated lands, river water to which sewage might gain access and shallow-well water are very dangerous. Spring water and deep-well water are wholesome and are also palatable.

Unfortunately in the case of water, as in many other things in this world appearances are deceptive and the clear sparkling appearance of a water or its agreeable odour and palatability are

no indications to its suitability and safety for drinking purposes as most polluted waters may be clear and are palatable; and although filtration through a few feet of soil might remove the disagreeable appearance, colour and smell of most filthy waters such filtration does not remove its dangerous properties.

The difficulty of obtaining for drinking purposes a wholesome quality and quantity of water is mainly due to the pollution to which water is subjected by certain evil habits of the people and it is largely owing to this pollution that diseases caused by microbes and parasites are so common in our Country.

In Tropical waters the presence of disease-germs and parasites and their ova or embryos are more common than in the waters of the temperate climates, where conditions for the growth of these are not so favourable.

The drinking of impure and contaminated water in the temperate climates gives rise to diseases, as we have said, like Infantile diarrhoea, Enteric fever and Cholera, but in India the use of a contaminated water gives rise not only to these complaints but also to Dysentery and several parasitic affections like Guinea-worm and Flukes infection. Goitre and Stone in the Bladder are very common in places where the water contains an excess of Calcium salts and salts of Magnesium.

Hard and soft waters. These characters of water will depend upon the geological strata through which it has travelled; a water that has passed through chalky strata usually contains in solution certain alkaline salts. Hence, rain water is the softest, being devoid of any alkaline salts. Spring water and water from wells (shallow or deep) do contain CO_2 and Ca Salts and are therefore hard. The hard waters from springs and deep wells are the safest waters being palatable also; but from an economic aspect hard waters are undesirable as they deposit a thick crust in boilers and do not produce free lather with soap, thus leading to wastage of soap in their use.

Wells. Shallow wells are those sunk into a superficial porous bed of sand or gravel which overlies an impermeable layer of clay or rock beneath. These wells draw mainly from the sub-soil water, which percolates into them from the

surrounding superficial soil; and if the soil be of a porous nature impurities derived from the surface in the neighbourhood of such wells will also percolate into the water polluting the water and rendering it unsafe for consumption.

Although the soil is able to remove some of the impurities at the beginning, the filtering power of the soil will eventually be lost, so that the sewage gets into the well in an unfiltered state and contaminates the water to a dangerous extent; and if the wells are, as is often the case, situated close to open drains, privies and other sources of pollution offensive matters drain into them and render the water positively dangerous. In fact, in most cases direct contamination is derived from surface washings.

Trees growing at the edges and lining of wells with their leaves falling into the water and decaying are common sources of pollution of wells; so also birds building their nests in crevices soil the water by their droppings.

As the supply of most wells is the under-ground stream moving steadily in the direction of its natural outlet, heavy rains might raise the level of the subsoil water and may wash impurities from leaking cess pools etc., into wells lying between and below the source of contamination and the outlet. Hence a shallow well may also be the source of danger not only from the surface but from more distant contamination.

The danger of contamination might be considerably minimised by improving the method of construction of these wells, by steining the wells with brick and mortar or similar impervious material; there should be a parapet wall about 3 feet high above the level of the ground to prevent surface washings from flowing into the well. All wells for public use should be protected by a cover and the water drawn by means of a hand-pump. The most important consideration in connection with digging of wells is that sites should be selected after taking into account the surface configuration, the nature of the soil and the possibility of contamination by the neighbouring heaps of rubbish, cess-pools, latrine, manured lands or surface water.

Tanks and Ponds. These are common sources of drinking water in villages and agricultural parts and are most easily fouled.

by people washing and bathing in them, by the passage of excrementitious matter of both human beings and animals directly into them, or by vegetable and manurial elements being washed into; sometimes cattle are bathed and surface drains are allowed to empty into them. Hence, proper precautions should be taken to protect such water supply from every sort of contamination.

Streams and rivers in their course through cultivated areas, towns and villages often take up impurities derived from sewage and industrial effluents particularly near the banks, and therefore such waters should be considered most unwholesome and unsafe for drinking purposes.

Purification of Water

The menace of water-borne diseases may be avoided by the adoption of certain methods of purification, and the first natural step is to seek out sources of initial purity and to protect them as far as possible from subsequent pollution. In fact, a public water supply should be such as will not require further purification by its consumers; and water derived from carefully protected springs and deep wells needs no purification, but in the case of surface water, river-water or water from any source liable to sewage or manurial contamination purification becomes necessary.

In Nature purification is carried on by **storage**; and storage is a real factor in the purification of public water supplies. We know that disease germs are parasites which can live only in the warm nutritious fluids and tissues of the animal body, and that outside the body in water or in earth or dust they die out readily in a few days. It is not, as we generally believe, the running water that purifies itself, but water that **stands** that purifies itself; and the death of disease-germs exposed to sun and other conditions that exist in lakes and reservoirs is astonishingly rapid. The factors, however, that bring about death of disease—germs in water are diverse. They are: (1) dilution by a large volume of water, (2) sedimentation, whereby the solid impurities gradually settle to the bottom taking with them the subtler particles also, (3) the action of non-pathogenic bacteria, (4) action of sunlight and heat

of the ultra violet rays and (5) the production of bacterio-phages (see under Cholera). It is thus obvious that lake water is a safer source of water supply for human consumption than the flowing river water. Vegetation, fish and other forms of aquatic animals do also help in oxidising organic impurities or devouring them.

Artificial purification. The primary object of purification should therefore, be, as we have seen, to remove from the water any traces of pollution (1) that are likely to produce disease; it is also desirable (2) to remove the suspended matter so as to give the water a sparkling and attractive appearance, and (3) to render the water soft if it is hard, so as to make it suitable both for domestic as well as manufacturing purposes. The commonest methods of artificial purification are:—

A. Distillation. This is the best method of purification of water, but in practice it is not economical if it is to be done on a large scale; moreover distilled water is flat to the taste and has an action on metals. It is the method commonly used on naval ships, and the supply of water at Aden is produced in this way.

B. Boiling destroys all sorts of germs even the most resistant of them and removes temporary hardness of water (by driving away CO_2 and precipitating dissolved Ca salts which we said forms a hard crust inside boilers). The escape of gases from the water during boiling renders it flat also. If boiled water is to be rendered tasteful it should be aerated, as by pouring the water several times from one vessel to another until it froths or through a sieve.

C. Chemical Agents. A hard water is one in which Ca and Mg. Salts are held in solution as carbonates and sulphates. Hard waters are not suitable for washing as, we said, they form no good lather with soap, and soap is thus wasted. It is also not suitable for cooking and in industries. Often the magnesium sulphate present in hard water gives rise by constant use to gastric or gastro-intestinal troubles. When the hardness is due to carbonate of Ca. and Mg. (kept in solution by the CO_2) it is called "temporary" hardness, as it can be removed by boiling. But when the hardness is due to presence of sulphates and

chlorides of Ca. and Mg. in solution and not dependent on the presence of CO_2 and therefore not removable by boiling the hardness is known as "permanent" hardness. Permanent hardness can be removed only by the addition of freshly burned lime to the water in the proportion dependent on the degree of the hardness; roughly about 6 lbs. to 100,000 gallons of water. (This is the proportion used to remove the hardness of the Thames water.

Alum is often used in the purification of water on a large scale. It acts by combining with alkaline carbonates and forming aluminium hydrate, which being colloidal and insoluble forms a flocculent precipitate; when this settles down it entangles with it suspended impurities and bacteria which also settle. Alum, therefore, has a clarifying effect on muddy water; it has no effect however on bacteria of disease except in strong solution. The amount of alum generally necessary is about 5 grs. per gallon of water.

Chlorination is a valuable method of purifying impure water and rendering it safe and is best suited for the water supply of armies, barracks and jails. Certain town-supplies are also rendered safe by chlorination. Water can be chlorinated by the passage of chlorine gas or use of bleaching powder and its substitutes like "perchloron" "caporit" etc.

Chlorine gas. The use of chlorine gas is the best and surest way but requires an expensive and delicate plant to carry out and is therefore suitable for large towns and installations in charge of expert engineers.

Bleaching powder. This is a white powder having a chlorinous smell and used for bleaching cotton and vegetable colours. It is unstable and yields free chlorine when it comes in contact with organic impurities, which are oxidised by the chlorine and rendered innocuous. It is, thus, a powerful germicide and renders the water treated with it safe for domestic use. The amount of bleaching powder necessary to add to the water depends on the percentage of "available" chlorine. Usually a freshly prepared bleaching powder has about 35% available chlorine, but if kept for some time its availability is often only

about 20%. A specimen for use should contain not less than 20%.

Generally speaking, 30 grs. of bleaching powder (of a strength of 25% available chlorine) will be required for 100 gallons of water or 4 lbs. per 100,000 gallons of water. If the bleaching powder is stronger or weaker than 25% a comparatively smaller or larger amount must be used. Now, to calculate how much bleaching powder is required to chlorinate the water of a well it must be remembered that a cubic foot of water contains 6¼ gallons. Having found out by actual measurement in feet the depth of water and the diameter of the well it is easy to calculate in cubic feet the total amount of water in the well, and judge of the quantity of bleaching powder required for disinfecting the well.

The required quantity of bleaching powder is put in a bucket, water added and mixed; then the whole is allowed to settle and the supernatent fluid poured into the well. A bucket is then let down on a rope into the well, allowed to sink and then pulled up and down several times to ensure a thorough mixing of the solution.

The water thus treated may be ready for use in about 4 to 6 hours, although a chlorinous smell persists for a day or two.

Chlorogen or Electrolytic Chlorine are ready made fluid preparations of chlorine and are highly useful for disinfecting water, being of a constant composition.

Perchloron and caporit are solids, said to contain about 60% available chlorine.

Potassium Permanganate. Also about 30 grs. per 100 gallons of water is generally required. The necessary amount is dissolved in a bucket of water, which is let down into a well by a rope, allowed to sink and brought up and down two or three times so as to ensure thorough mixing. After several hours a pink tinge still persisting in the water indicates that a sufficient quantity of the permanganate has been used.

D. Mechanical means of Purification. Filtration of water by some means or other has existed in India even from the days of the great Manu, who recognised the necessity for purification

of all drinking water, but the method advocated was to filter through a few layers of cloth. This method is, of course, inefficient, as it can remove only the grosser and suspended particles from the water and not the harmful germs of disease, the destruction of which can be accomplished only by boiling the water filtered through cloth.

Filtration through sand and gravel--"Slow Sand Filtration" is the modern method of improving the water supply of most of our towns; and simple filtration through sand-beds was first introduced into England by James Simpson as early as in 1829 for the purpose of improving the appearance of water, and which proved, when bacteriological methods became available later for accurate study, to be equally efficient in removing intestinal bacteria such as the germs of typhoid fever, cholera, dysentery and bacillus coli.

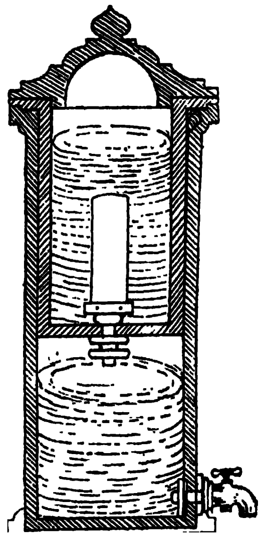
If one studies under the microscope the relative size of bacteria and of sand grains it would be obvious that there is ample space for bacteria to pass between the relatively huge masses of sand or gravel, but as a matter of fact the bacteria are strained out by a process of adhesion aided by the formation of a glutinous film on the surface of the sand grains throughout the bed; and experience has shown that passage of water through a a 4 feet layer of sand of the proper size will render even a heavily-polluted water safe for consumption.

As the rate of filtration through sand filters is comparatively slow and requires a large area of filtration bed and is likely to be suspended altogether after a time, an improvement on the purely mechanical filtration is to treat the water before filtration with some form of coagulant like alum, which as we have seen, forms a flocculent (wool-like) precipitate and serves as an additional filtering layer. As a result of the better filtering action thus secured the rate of filtration can be greatly increased and as a result of this increase in the rate of filtration the filters can be made much smaller, but of course must be cleaned more frequently and must be washed throughout their depth instead of merely removing the surface layer as in the case of the Slow Sand filters. The improved process is known as the Rapid Sand-Filtration.

It would be out of place here, however, to give a detailed description of these two methods, for which the reader is referred to larger books on Public Health

Domestic Filters. There are several varieties of these available in the market, the most convenient being the Pasteur-Chamberland and Berkefeld filters.

They are the only filters much used in houses and camps nowadays, because the Pasteur and in a lesser degree the Berkefeld (Fig. 1) really possess the property of efficiently rendering the filtered water free from bacteria of disease. The filtering material in these is a hollow candle composed of unglazed porcelin or silicious earth. They are not, however, without their disadvantages. as the filter candles do soon become blocked up especially if the water is muddy and filtration through them becomes inefficient. The candles should, therefore, be cleaned every week by brushing them with hot water and then sterilised by boiling in water containing some Sodium Carbonate. Muddy water should, therefore, be first strained through a thick layer of cloth or through sand and then poured into the filters to be further cleaned. It is, therefore, evident, that unless properly cleaned at intervals these filters are not only useless, but positively dangerous, because instead of purifying the water they contaminate it from the residue left behind by water that has previously passed through. If such residue is not got rid of the germs of disease will grow and multiply and the water passing out of the filter may be infinitely more dangerous than the water that went into.



(Fig. 1)

Berkefeld Filter.

Charcoal Filters are often used by aerated-water manufacturers in order to obtain clear sparkling water. These filters do not remove the germs of disease from the water. They are, therefore, a source of danger to consumers of such aerated waters. To avoid this danger the charcoal requires to be occasionally cleaned by soaking in potassium permanganate solution for some time.

Test for Germ-free water. The pathogenic or disease producing bacteria contained in water are fewer compared with the non-pathogenic or saprophytic bacteria and are difficult to isolate. Hence the usual method adopted is to detect and isolate organisms like the Bacillus Coli, not usually found in natural water, but always present in excreta, the inference being that if common foecal bacteria can find their way into any water other pathogenic bacteria will also be present with them.

4. The Soil in Relation to Disease

The upper few inches of the surface soil contain innumerable number of bacteria and they are very few below the depth of 4000 feet in an undisturbed soil. Their number, however, is considerably larger in a cultivated soil than in the uncultivated or dry and sandy soil. The bacteria found in the soil are of two types. The saprophytic bacteria i. e. those concerned with the decomposition and disintegration of organic matter (animal and vegetable) and pathogenic bacteria (or disease-producing germs). The saprophytic are found in greater abundance and are concerned with the final disposal of all organic matter such as animal excreta, sewage, dead bodies, vegetable matter etc. If it were not for their presence in the soil the surface of the Earth would have long become clogged wtih organic refuse and man's existence would not have been possible.

The pathogenic bacteria contained in the soil are, however, much fewer than the saprophytic as they do not find a suitable medium in the soil for their growth and multiplication, and they die also in the struggle for existence with the saprophytes. But the soil does, however, contain certain bacteria (pathogenic) such as

those of anthrax, Tetanus, Malignant oedema, etc., which being spore-bearing are more resistant against adverse conditions such as drying, heat etc.

Although few pathogenic bacteria can actually live in the soil for a time a soil polluted with human and animal excreta urine or sputum may come to contain the specific microbes of Typhoid, dysentery, Epidemic diarrhoea and cholera and give rise to these diseases from infected or polluted soil through the medium of water, dust, flies etc.; certain vegetables grown on a polluted soil may communicate if eaten uncooked the ova of various intestinal worms, hook worms and round worms from the soil to the consumers. Some forms of tape-worms pass part of their life cycle on or in the soil.

A damp soil is, as a rule, unhealthy and when permanently wet contains much decomposing organic matter. It is a well-known fact that the general health of a community living near a damp place is much lower than the health of one living near dry places. They are prone to get diseases of the lungs and perhaps water borne diseases also and malaria and filaria (mosquito-borne diseases). Rheumatism is very common in damp places.

For the same reason a "filled" soil or "made" soil as is produced when tanks and low-lying places are filled up with refuse matter is very unhealthy as both the atmosphere and the water-supply are likely to be polluted thereby and consequently the health of the inhabitants suffer greatly.

5. Sunlight

Biologists have shown that solar radiation has been the most powerful environmental factor in the evolution of life, which has culminated in the human-being. Even the primitive man evidently recognised this fundamental importance of sunlight for his very existence and worshipped the Sun as his God. But with the development of culture and dawn of civilisation he gradually began to retreat from the "light". First, he excluded the sunlight from his body under the impulse of adornment or modesty or protection from heat and cold by clothing it; next, he devised

dwellings in which he spent mostly his time shielding himself and his belongings from the Elements but excluding the beneficient rays of the Sun. Thus from the bright daylight of the farm he led himself into the shadows of the factory, and when he built the modern city with its tall edifices, cramped houses and narrow streets he made direct sunshine a comparative stranger; and when finally its atmosphere became polluted with smoke, dust, gasolene fumes and toxic gases from industries and overcrowding the most vital and energising rays of the Sun were practically shut away from him.

However gloomy this picture be it is not without a brighter aspect; for Science and commonsense have led to a new realisation that both life and health demand a reasonable dose of the all-energising rays of the sun, and so the new cult of the sun began with its sunbaths and other means of exposure to the ultraviolet rays. The action of the ultraviolet rays on the skin is at first to produce a superficial redness by influencing its circulation, followed later by the pigmentation of the skin, known as the sunburn. This pigmentation of the skin insures a greater tolerance of the body against heat rays (the thermic rays) of the sun reducing thereby the oppressive effect of solar heat and permitting absorption of more ultraviolet rays. The tolerance so produced also does away with the tendency of some people to easily "catch cold" even on the slightest exposure.

The action of ultraviolet rays on the skin may affect the whole body as has been proved by their power to cure rickets. Roller credits sunlight on the skin with favourably influencing the haemoglobin contents of the blood, the internal secretions of the endocrine glands, the digestive function and the general weight and strength. Further, the regulation of circulation helps to make the musculature firmer and better than the best massage.

Cases of carbuncles, chronic eczema, lupus and alopecia are rapidly benefited by exposure to the ultraviolet (U. V.) rays, as the inflammation so set up brings extra blood and lymph to the affected part and these cause healing. A carbuncle in the early stage is made to abort thereby and much pain and trouble saved. Bernhard of St. Moritz exposed war-wounds to sun and

air with good effects. There is no better dressing.

Properly controlled solar radiation in open air influences favourably the *Basal metabolic rate (B. M. R.) particularly if accompanied by exposure of the body to air and bathing in salt water. It is well-known that after a well-contrived exposure of the entire body to the U. V. rays most people feel invigorated and are in a better frame of mind, their psychological tone being distinctly better.

The chief effect of the U. V. rays is to maintain a proper Calcium balance in the system and build up its bony frame-work (by activating ergosterol in the skin in such a way as to produce Vit D.) Even before the baby is born its skeletal development is influenced by the sunshine that reaches it through the mother, and the fundamental importance of sunlight in building and maintaining the bony frame has now been proved both in health as well as in rickets. This does not mean that proper food with an adequate amount of Vitamin content is not a necessity. A working labourer with his scant cloth whom we might be inclined to despise is really a wiser man than ourselves for he allows himself to be nourished and strengthened by the sunshine and fresh air that feed him perhaps more than the rice or ragi he eats. The same reasoning applies to teeth as special bony structures, which have much the same needs for growth and a sufficient amount of sunshine.

Sunlight is even reputed to give antirachitic properties to most substances like cereals, meat, milk etc., and accelerates the growth of both animal and vegetable life.

Sunlight retards the growth of all bacteria and various protozoa and exerts a most favourable action on Tubercular patients.

Various vermin and insect-pests are readily destroyed by sunlight and decomposing organic matter is changed into innocuous compounds.

Many research workers have found that direct sunlight produced changes in the rate of respiration, increase in the amount of CO_2 output and in the rate of growth in the immature

* Will be explained under Dietetics.

organism. Others have apparently found that the intensive light conditions prevailing in most deserts stimulate the activity of the blood-forming organs to combat anaemia and increase the number of phagocytes. In India we have always an abundance of sunlight, but our perversity has ordained that this great life-principle should be debarred from many. The purdah-system prevailing in our Country keeps many women and children practically shut off from sunlight. Such people easily fall a prey to tuberculosis and chest complaints and even adults are affected with rickets The generally lowered vitality, the increased tendency to rickets and anaemia, lowered resistence-power to deseases like Tuberculosis among the ''slum''—dwellers of our towns are accounted for by the fact that our streets are often too narrow to admit more than a sampling of sunlight and there is lack of open space for play and relaxation in the sunshine.

Let us, therefore, hope that the popularisation of the knowledge as to the effects of sunlight on health will bring about a reformation in our habits of building and town planning, living and clothing.

Lighting. Good lighting is as much essential in the home as it is in the school or work house. It enhances the comfort of the occupants, encourages reading and study, increases the working efficiency, reduces the frequency of accidents, aids in safeguarding against certain forms of eyestrain and makes possible an increase in the length of the activity-day. And from all these points of view day light is preferable to any form of artificial lighting, which is very deceptive to colours also. Our eyes have through long ages gradually adapted themselves to the white light of the sun, and it is common experience to find that in no other light than the well diffused white light of the sun can the eyes do as well the usual amount of close work. Particularly is this true of one whose eyesight is below normal. Such a person will often be found able to read fairly comfortably and for several hours in daylight but will show definite signs of eyestrain even after an hour's close work by artificial light.

Another value of daylight, we have seen, is in its ability—through its U. V. rays—to activate ergosterol in the skin in such a

way as to make it act like Vit. D to enhance the utilisation of Ca and P found in the food, thus preventing or curing rickets and certain forms of "neuroses," like tetany and chorea (St Vitus' dance) among children. This action is, of course, strongest in bright sunshine, somewhat less strong in ordinary skyshine and almost entirely lacking in sunlight which has lost most of its U. V. content by being filtered through window glass pane.

The more definite and measurable effects of sunlight upon the human body have been well summarised by Clark, and though the evidence is far from being all in, it is already clear that for the maintenance of optimum health it is essential that we provide in our housing for a reasonable amount of sunlight.

Now, the condition of our houses as a rule provides no outside light for more than a few rooms at the most, and some of our streets too narrow to admit direct sunlight; and the rows of houses lined side by side as in large cities admitting very little sunshine stand as mute evidence of the fact that our people have not yet been convinced of the importance of sunshine to health; but as we mentioned above, it may be hoped that the popularisation of this knowledge and the removal of the crude notions of sanitation may bring about a reform in our habits of building and living. To ensure sunshine throughout the day in our streets it is advised to build houses facing north and south.

We repeat that though in India we have enough of the life-giving sunlight, our perversity has so ordained that this great principle should be debarred from most of our women and children, especially those observing the purdha-system Again, in our large cities great number of people are herded together in houses which are crowded and dark with stagnation of air. Rickets and Tuberculosis are, therefore, very common among such people as among the slum-dwellers.

Light for Reading. For reading work the sky shine obtained through the windows opening on the northern side of a building is generally to be preferred. Seating in the house should of course avoid the need of openly facing a sunny window and thus being exposed to direct glare. Shades and window curtains should be so chosen and arranged in our sleeping rooms that

the early morning light can be properly controlled and prevented from waking or producing head-ache in those sleeping. The tendency to shut off all sunshine from the home for the purpose of preventing coloured furnishings from fading is one which from the health point of view should be combated.

Artificial Lighting. The average intensity of illumination out of doors in the day time is approximately 1000 to 2000 candle powers in India, but the intensity of indoor illumination is 10 to 20 candle powers. So great is this difference in the illumination that on a bright day watering of the eyes, photophobia (fear of light) and extreme contraction of the pupil often follow stepping out of doors after a number of hours indoors.

For close work very few persons find the high intensity of out door illumination agreeable.

For direct illumination on desks, printed matter and work-benches much higher intensities of illumination are found useful.

There is a factor in illumination which is often ignored, but which is of great importance; it is the ratio between the intensity of directed illumination and the intensity of general illumination. To sit in a dark room with a minimum of general illumination and read with the white page flooded by directed light, say of an intensity of 10 to 15 candle powers is unphysiological and is conducive to eyestrain for the reason that the pupils of the eyes are required to adjust at very frequent intervals from marked contraction (caused when the eyes are directed to the bright paper) to wide dilatation (when they look up into the comparative darkness of the room).

Avoidance of glare of the artificial light can be accomplished by avoiding bright lights against a dark back-ground and in the direct field of vision. In fact the solution to the problem lies in properly diffusing the general illumination and directing the directed illumination away from the eyes but upon the work.

The use of the old-fashioned goose-neck desk-lamp for desk work is still a common hygienic fault in many homes; the argument however, being adduced in its favour that by taking advantage of its flexibility one can easily avoid the necessity of receiving in the eyes the direct rays from the bulb. This may be true,

but the fact remains that no matter where such a lamp is placed on the desk it will still be in front of the eyes and light is, there fore, bound to strike the white paper from an angle in front of the eyes and directly reflect into the eyes; and the more highly glazed the paper the worse is the effect, often in the case of glazed paper even the filament of the bulb is reflected.

The only way to direct the light properly from the back with a desk lamp is to place it on another table or stand well behind the eyes. This is often a very cumbersome arrangement and since the old rule for directed light—"always behind in reading, to the left and behind in writing for the right handed person, and to the right and behind in writing for the left handed person and in the case of Persi-Arabic or Cyrian script"—is still good it is recommended to taboo the short desk lamp and use the floor-stand-lamp in its place as the latter can be so easily placed at the back of the reader.

The study of our present day home lighting leads us almost inevitably to the conclusion that there lies here a vast field for improvement. Few indeed are the houses that could not be benefited by greater attention to the intensity, colour, diffusion and direction of their lighting.

II. General Sanitation

We have seen that environment and character of the houses and localities where people live have much to do with their health and happiness, and that bad dwelling conditions and unclean habits predispose to disease by lowering their general vitality. Unfortunately the sanitary conditions of many of the houses that are now occupied are not capable of improvement, nor is it possible to change the peoples' habits, because once they are formed it is almost impossible to break away from them. The one hope of Sanitary workers lies however in the education of the younger generations in the ways of cleanliness and thrift and in the building of Sanitary dwellings in the future.

The lack of air and light in houses and tenement-buildings, the lack of open-space for children to play out of doors, the dirty and sometimes filthy door-yards and houses of the poor, all these predispose especially the children to ill health and premature death.

Under the head of General Sanitation come a number of health problems commonly known as "Nuisances." These include the disposal of Refuse and Waste material, the control of Vermin and insects, and a number of miscellaneous items as spitting, air contamination with smoke, dust, obnoxious odours and vapours from trades and industries etc. Some of these will be discussed under Industrial Hygiene.

1. Disposal of Refuse

The general health of a community largely depends upon the efficiency with which all refuse (including animal and human excreta) is collected and disposed of, as all organic refuse matter such as garbage, leaves, vegetables, rotten fruits, kitchen waste, stable litter and street sweepings, horse and cow dung etc.,

are liable to undergo putrefaction in the presence of warmth and moisture, and give off offensive smell or serve as breeding places for flies, places of refuge for rats, vermin etc. Hence the need for their early removal and effective disposal. The refuse should be collected in water proof pits or metal dust-bins as its deposition on the open ground or on the roadside is objectionable being liable to be scattered about by the wind or stray animals, or washed out of the heap during rain. The dustbins are best made with corrugated iron, the simplest shape being a circular one open at both ends and provided with two handles. They should be placed on a water proof cemented surface always at a fair distance from a house and provided with a suitable cover.

In India owing to climatic conditions and rain the refuse decomposes rapidly and flies and mosquitoes and vermin multiply equally rapidly. It is, therefore, necessary that the contents of the dust-bins should be removed daily or more frequently by especially constructed carts, which are preferably made tiltable for facilitating their emptying at the place of disposal of the refuse. The refuse carts should be properly covered to prevent nuisance while being driven along the streets, while the collection itself should for the same reason be done during the early hours of the morning when traffic is slack.

After collection the refuse should be disposed of in such a manner as not to create nuisance in the neighbourhood of dwellings nor to contaminate the source of drinking water in the neighbourhood. **Dumping** and filling in-sanitary lands or reclaiming low-lying lands is the common method of disposal; but since this creates a great nuisance to the neighbourhood by the production of offensive gases and breeding of flies and harbouring rats and other vermin it is necessary that the land selected for the purpose of dumping should be as far away as possible from human habitation or outside the limits of the town, so as to be far away from drinking-water source also.

Incineration or burning up of refuse so as to render it harmless is another method of disposal. This is generally done in special types of incinerators; the refuse is thereby reduced to about ¼ or less of the original mass and the dangerous and evil

smelling organic matter is transformed into innocuous vapour and residue. The residue left after combustion is a mass of hard material called "clinkers" which may be utilised for road making and makes good cement on powdering and mixing with lime. Provided that the draught of air feeding the fire is properly managed even the simplest form of incinerator is perhaps the best.

Refuse from private houses, jails and hospitals are most easily got rid of by incineration and often the residue left behind is found to be good manure for cultivation.

2. Disposal of Human Excreta

Human excreta should always be regarded as the most infectious material, as the germs of Typhoid fever, Cholera and Dysentery and ova of intestinal worms like the hook-worm and the round-worms pass out of the bowels of the infected individuals with their excreta; and if conditions and opportunities are favourable these germs or ova gain entrance into the alimentary canal of other healthy individuals and produce the specific diseases in them. Carelessness or ignorance of people has in the past perpetuated favourable conditions and opportunities for the passage of infected foecal matter through the medium of drinking water or food and epidemics of Cholera, Dysentery and Typhoid (known as bowel-complaints) used then to be more frequent. Later when the causation of disease became better known and the mode of spread better understood all such epidemics were found to be preventable by the proper disposal of excreta and protection of water and food supplies from contamination thereby. Luckily the microbes of bowel complaints or the ova of intestinal worms do not survive long even in sewage water especially if it is properly treated and precautions are taken to prevent sewage from gaining access to drinking water supplies.

The water-carriage system of disposal of excreta, which has been installed into most of our municipal towns has been helpful in banishing epidemics of bowel complaints from these

towns and this system is still held to be the best preventive against them. Unfortunately the system cannot be introduced into our villages, where, therefore, other equally efficient sanitary methods have to be adopted regarding the disposal of excreta.

The disposal of excreta is not only a sanitary measure but is helpful from aesthetic stand point also in that it develops in the community a "Sanitary Consciousness" by which they are tempted to live no longer amidst excreta-smelling surroundings. In fact the aim of sanitation in the disposal of excreta is to convert an offensive putrescible and dangerous material into an an inoffensiye and innocuous one by methods which are at once cheap, convenient and efficient. This object is accomplished in nature by the action of certain nonpathogenic or saprophytic microbes—the nitrifying micro-organisms normally present both in the excreta and in large numbers in the soil; and on the efficiency with which human excreta and refuse-matter from cowsheds and stables, street sweepings and waste water from houses and factories, slaughter-house refuse etc. are disposed of depends the freedom of a community from disease.

The material welfare of a community can, therefore, be said to be directly dependent on its methods of disposal of excreta, and is a measure of its civilisation.

In villages and municipal towns where there is no water-carriage system arrangements should be made for the removal of excreta from privies by what is known as the "Dry method," the principle to be kept in mind being that no filth, refuse and putrecible matter should be exposed to flies or allowed to contaminate water, but be transported and disposed of in such a manner as not to cause least possible nuisance to community. Foecal matter especially when mixed with urine undergoes rapid decomposition in the presence of heat in the tropics and gives rise to foul gases like ammonia, sulphuretted hydrogan and organic vapours.

In villages people generally resort to the garden or some open land for answering calls of nature. This is a very insanitary practice, as during the rains the surface washing might easily

flow into tanks and other sources of water supply and contaminate the water with the germs of water-borne diseases; such defects should be overcome by the provision of properly constructed privies.

The privies should be built on a raised impervious base and should be so constructed as to keep off rain but not shut out sunlight; the flooring should be cemented to facilitate cleansing and prevent pollution of the soil through soakage; separate receptacles should be provided for night soil and urine and washings so as to keep them separate to prevent fermentation and facilitate their removal.

Several varieties of latrines are in use and they do not call for a description here. But the most satisfactory type of them suitable for rural areas, for tea gardens, during fairs and festivals are the "Trench latrines," which are made by digging long trenches 8 or 10 inches wide and 1 to 2 feet deep. The person using it places one foot on either side and squats in such a manner that the solid excreta, urine and ablution water falls directly into the trench. They should be properly screened and partitioned if necessary; and should be filled up with the excavated earth when they are sufficiently full.

The final disposal of excremental matters, night soil and the urine is effected either by "trenching" or incineration in places where there is no water-carriage system. In the case of "trench" latrines the trenching is done *in situ* without having to remove the excreta to a specially made trenching ground.

A trenching ground is a plot of land where the night soil is disposed of by burying it in the soil. It should be situated outside the town and atleast ¼ mile away from the nearest dwelling house and preferably on the leward side of the prevailing winds; the soil should be light and porous, clay soil being the most unsatisfactory. The nitrifying organisms, which are more numerous on the upper layers of the soil convert the organic material of the excreta into innocuous nitrates, which are left behind in the soil after the process is complete. It has been found by experience that a trench 2 feet broad, 2 feet deep and 20 feet long filled with a layer of night soil 8 to 10 inches deep

and closed over with the excavated earth will be sufficient to deal with 100 gallons of night soil, and that under favoureble conditions the nitrifying process will be complete in about 90 days; so that after this period if the trench should be opened up there will be left no trace of foecal matter and that instead it has all been converted into a soil of high manurial value fit for cultivation purposes, and perfectly free from smell or germs of disease or ova of intestinal worms.

Incineration is a useful mode of disposal of night soil in a rapid manner and is a method commonly adopted by municipalities where trenching is not convenient.

3. Disposal of Slop Water

The removal and efficient disposal of domestic and other water of towns and villages is a very difficult sanitary problem, for these are no less impure than the ordinary sewage of water-closet towns. The slop water from isolated villages is usually conveyed by pervious drains, which are mostly shallow open trenches, to the nearest tanks, garden or open land. Often there is no proper slope to permit the water to pass with sufficient velocity to carry solid filth and prevent its deposition. As a result these drains form suitable breeding places for mosquitoes and flies; and the sewage may often soak into the ground and pollute the neighbouring fresh water supply and during the rains form dirty offensive puddles. Often weeds or plants growing in such drains materially impede the free flow of the sewage.

To remove these difficulties it is advised to have the drains constructed with brick and mortar or any nonabsorbent material; they are made preferably "V" shaped (on section) with proper inclination, so that even a small amount of water will suffice to flush them and minimise the amount of water standing in them. The sewage can best be disposed of by irrigation over agricultural lands or open fields, while the slop-water of individual houses may be collected in suitable pits or tubs and then removed to some cultivated land or to sea for final disposal.

4. Disposal of Sewage

Waste water consisting of liquid and solid human excreta from the wash-down type of closets together with liquid refuse from cowsheds, stables, houses and factories is known as 'sewage,' and waste water from houses etc. unmixed with solid excreta is "sullage".

The primary idea in the purification of sewage is to convert the harmful complex organic matters contained in the sewage into innocuous and simple inorganic chemical compounds. This result is obtained by the "oxidising" action of certain types of saprophytic bacteria normally present in the sewage itself, in the presence of sunlight, an action similar to but not identical with the action of the nitrifying organisms on the trenched human excreta.

The process of purification of sewage by the action of microbes is known as the "biological treatment" of sewage and consists mainly in the application of the liquid sewage (after (filtration) to specially chosen porous land; which after a time comes to retain in its soil only the inorganic nitrates and other oxidised products of the organic contents of the sewage. These have a high manurial value and the land may consequently be utilised for the cultivation of coarse-grass, sugar-cane, plantains, green vegetables etc., with profit. Ordinarily no harm results from the consumption of vegetables grown on such farms, but it is desirable that such vegetables should be properly cooked with heat so as to destroy any ova of intestinal worms that might possibly remain alive in badly managed farms.

5. Industrial Hygiene

While it is almost impossible to change the habits of the members of a household it is possible by Law to govern the conditions under which people may work for others. This is Industrial Hygiene; and there has been no branch of the Sanitary science that has made greater strides in later years than this one. The working conditions of millions have been improved and many

lives thus saved. Factories are now built with the idea of the comforts of the employees in mind, and the dangerous and hazardous trades have been made more safe by the introduction of safety—devices on every machine on which this is possible. Dust, which in the older days predisposed workmen to lung troubles have been eliminated by the installation and use of suction-blowers. The modern employer finds that attention to these details and to light, ventilation and cleanliness save money in the long run. In many factories medical examination of all workers is compulsary and many incipient diseases are thus detected and corrected.

Child labour is gradually becoming the thing of the past in most countries, and hours of labour for adults are shorter and in some cases very short, so much so the general health of the labourers is much better than on former conditions.

In some trades workers handle materials which are poisonous or injurious to their health Diseases produced under these conditions are known as Industrial Diseases. The most common of these are poisoning by phosphorus, arsenic, lead, brass and mercury. Government Inspection of factories engaged in the manufacture of articles in which such dangerous materials are used has considerably lessened the incidence of these diseases.

"Caisson disease" or "bends" which develops in labourers working in atmospheres of increased air-pressure is another example of occupational or industrial disease. The trouble is now entirely eliminated by very gradually reducing the air pressure surrounding the labourers while they are returning to normal atmospheric air pressure.

III. Personal Hygiene

I. Cleanliness

Our ideas of the significance of cleanliness have an ancient as well as a complex history. We find some tracing their origin to religion. Primitive people had an elaborate ritual calculated to satisfy the supernatural powers of evil, and in order to accomplish this a great variety of actions came under a taboo. The penalty for the violation of the ritual was to be declared as "unclean", which meant that the individual was unfit and unable to perform the rituals upon which his own welfare and that of his community rested. The affected person became thus a danger to society and was temporarily outcast from it. He was compelled to recover this psychological cleanliness before he could be readmitted into society. This recovery of cleanliness was accomplished through acts and rituals that still continue to be symbolised in our modern ideas of cleanliness.

Primitive people, then, considered cleanliness a matter of the spirit even though their ritual meant a certain amount of physical endurance also.

Most of the ancient religions gave a prominent place to cleanliness and in some of them it acquired a definite relationship to disease. The followers of Zoroaster could not travel by sea very conveniently, because they were forbidden to defile the sea under penalty. Women were held "unclean" under a variety of circumstances, as at menstrual periods or at child birth, which were occasions requiring unusual precautions in order to recover cleanliness after these physiological processes. Even to this day the Parsi home sets apart a room for the monthly seclusion of women.

Among the Greeks marriage was preceded by a ritual of

purification, and the "marriage bath" was one of the most essential items in the wedding-rites. Death and dead bodies produced uncleanness that required purification by water, fire and smoke.

The evolution of the idea of cleanliness reached an important hygienic stage with the Hebrews. While its objective was religious we now find that the Hebrew ritual afforded equally essential protection from dangers of desease. It is said that the Book of Leviticus contains a remarkable collection of sanitary regulations. The minute directions regarding foods that were considered unclean have greater significance than their religious purpose. The purification of the woman after child birth may be easily interpreted as a sanitary measure if consideration is given to what was required of an unclean person. The ritual with reference to leprosy presents the most striking example of a combined religious and hygienic application of the idea of cleanliness. It reads almost like the work of the modern Health Officer. It sets a standard of biological cleanliness, which sanitarians are still struggling to attain.

The prominent place accorded to bathing in certain religions has been responsible for the establishment of cleanliness as an important factor in life. While much of our bathing is done for other reasons than health the results of a clean actively functioning skin are well recognised values.

The most significant step in the evolution of our modern idea of cleanliness arose out of the establishment of the true relationship of filth and dirt to disease. In earlier times dirt was considered not only the vehicle but the actual generator of disease. Dust was so frequently associated with pestilence that it was thought to be dangerous and so was dreaded. But we have already learnt that dirt is not dangerous because it is "of the earth earthy" but only because it may act as a vehicle for maintenance or distribution of living microbes of disease.

The psychological relationship of cleanliness is of significance. The association of cleanliness with beauty led to a new interest in bathing as an adjunct to feminine charm. At first it was considered somewhat beneath the male, but its general

acceptance by both sexes has come with the realisation of the value of feeling of well being resulting from bodily cleanliness.

Cleanliness is not merely an aesthetic adornment though doubtless an acquired taste. It is above all a sanitary safeguard, the importance of which has been learnt by hard experience. In other words, to be clean is in a large measure to be safe from infectious disease; and cleanliness applies not only to the person but extends also to the personal environment.

The effects of cleanliness are: (1) There is no doubt that cleanliness of the skin and the mucous membrane of the respiratory tract is an important factor in normal function. The skin by the very nature of its structure and function requires that its surface should be kept free from extraneous material if it is to serve its purposes as a protective, heat-regulating apparatus and as a supplementary excretory organ. The superficial layers of the epidermis are gradually transformed into dead horny scales, which must be removed, or they will interfere with the function of the skin glands. The secretion of sweat glands produces some waste materials that need be removed. During perspiration either on a hot day or on severe muscular exertion there is a tendency for the dissolved solid of the sweat (such as alkaline salts, urea, oxyacids, uric acid etc.) to remain on the skin surface and in the ducts of glands. Their removal is necessary for effective functioning. Sebaceous glands produce in addition to the wastes mentioned above an oily secretion, which acts as a lubricant to the skin and hair. The blocking of the ducts is an important cause in the condition known as "black heads" commonly present on the face of fair people.

Another important factor in retarding the activity of the skin is overclothing with garments which do not properly absorb perspiration or regulate body-heat.

The feeling of wellbeing produced by a satisfactory bath after work involving soiling of the body by dirt or perspiration is well known. This effect is more than a mere mechanical removal of extraneous materials, it means definitely improved functioning of the entire system.

Cleanliness of clothes produces a favourable psychological

effect upon the average individual, and even the most phlegmatic individual(sluggish, inactive)has his feeling and tone improved by clean clothing, though he may get apparent joy from a dirty one.

Environmental cleanliness is a highly important factor in satisfaction. This is especially true when food is related to the idea of uncleanliness. Any suggestion of dirt connected with food or food stuff brings almost a universal dissatisfaction, disgust and vomiting. The same results if cooking vessels are also unclean. Most of these emotional reactions are unsound.

It is to biological cleanliness or freedom from bacteria that health owes its greatest debt. As living microbes, as is well known, are the real causes of disease freedom from these means freedom from disease.

The cleanliness of personal environment has equally great hygienic value. No one should use the common drinking cup; contaminated water and infected milk should be excluded, or rendered clean and free from bacteria as by boiling before-use. Purification by cooking is one of the greatest sanitary advances ever made by man and is the only means of rendering a food safe for consumption.

Personal cleanliness is as important as the cleanliness of our houses, streets and places of resort. The public should be convinced of the usefulness of cleanly surroundings. This can be accomplished by proper instruction of children and adults in the technic of cleanliness based upon proper knowledge and the knowledge should be translated into habits.

Habits of Cleanliness. Cleanliness is largely a matter of habit and is a desirable quality. Habits of cleanliness may be acquired by the passive influence exerted upon individuals by a clean environment. Children and adults forced to live constantly in unclean surroundings seldom maintain a high standard of personal cleanliness, and the first step in a proper set for the desired quality is to provide a satisfactory environment. Of equal importance with the environment are the examples set by the associates of the individual. Clean habits by the adult members of a household make greater impressions on the child than all precept and advice.

Active participation is the other factor in habit-formation. If the individual can be convinced of the benefits of cleanliness and induced to apply them thoughtfully and sufficiently often, then habit will be established, and once established it becomes his second nature and will be a valuable guide all through his life in protection from disease.

Bathing. Throughout history and in most religions bathing has had a place as a sacred rite. Oriental religions particularly of the warm climates have incorporated bathing in their religious ceremonies.

Rome was noted for her gorgeous baths conducted in a manner that became an impossible luxury. The practice of bathing declined, they say, among the early Xians because purification of the body was considered to be detrimental to the development of the soul. The revival of the popularity of the bath came through the discovery of the Court-beauties that cleanliness and beauty seemed to have a causal relation. The invention of soap led to much experimentation with all kinds of devices and materials to aid in cleanliness.

Baths cleanse the body by removing from the surface of the skin the dead epithelial cells and the dissolved solids left from sebaceous and sweat glands and any dirt adherent thereto. Friction of the clothing may remove some of this material but dissolving it in water or soap water is the only effective method. Proper baths serve to keep the ducts of the skin glands open, so that the skin may function freely and to remove any unpleasant odours from the body.

The circulation through the skin is stimulated by hot baths; cold baths in health are a distinct stimulant and tonic to the nervous system. The best time for bath is early morning and the water must be of proper temperature as judged by its reactions on the individual. Properly applied baths do greatly improve the appetite, the digestion and elimination. A warm bath after the day's work is a good sedative.

Heat applied to the skin by baths, hot water bottles and fomentations or radiant heat sources is only limited to the skin surface and does not produce deep heating; but in the case of

the High Frequency current, the heat penetrates deeper throughout the field. Deep inflammatory conditions of accessible organs like the prostate and the uterus can thus be relieved and also the backache and longstanding dull sickening pains dependent upon them.

A hot bath followed by a cold douche is most stimulating to the skin and by way of the nerves and alterations of blood supply affect the whole system. In the hot bath the skin is flushed with blood and lymph and sweat is poured out, whereas by the cold douche blood is drawn out of the skin into the deeper organs.

Heat in all forms flushes the skin and brings more blood and lymph to the heated parts, increases the temperature and raises cellular metabolism. By heat the tissues are relaxed and softened and pain relieved. A patient crippled with chronic rheumatism can then move the affected joints with much less pain, and such active exercise is more effective than massage in bringing relief.

Habits of cleanliness can minister effectively not only to mere maintenance of life but also to a raised level of health, and cleanliness of the body and the environment are among our most effective methods of prevention of communicable disease.

Oil Bathing. The Indian custom of anointing the body and head with oil before a hot bath has the advantage that it keeps the skin from becoming overdry or cracked in the cold weather and prevents injury to the skin from exposure to the burning rays of the Sun. Oil baths do also prevent the epithelium becoming sodden as in the condition known as the "washerwoman's" hands. Moreover the oil facilitates shampooing the body which may with the best advantage be done before a bath. By kneading and rubbing the circulation is quickened and the muscles exercised (passive exercise) giving a refreshing feeling.

2. Exercise

The maintenance of health in the normal organism is determined largely by the proper relation of the two great

factors—activity and rest; and exercise taken with due regard to the individual requirements of age, sex, occupation and capacity helps not only in maintaining health but is a valuable adjunct to recovery from disease.

A moderate amount of exercise is, therefore, necessary if the body is to be properly developed in youth and maintained in a healthy state all through one's life-time. Many of the ailments of people leading sedentary lives are mostly due to neglect of physical exercise, and no amount of care in dieting or drugging will sufficiently make up the deficiency.

Exercise is chiefly the use of muscles with a particular object in view and requires the co-ordinated action of the circulatory and the nervous systems. Now, muscle is a chemical engine for transforming energy latent in the body into mechanical action, and in order to function satisfactorily the muscles should be well nourished and should have "good tone" or firmness and resilience. The hardness of an athlete who has developed and trained his muscles is well known compared with the softness of a sedentary indoor worker.

Modern civilisation has, however, tended to increase mental stress, decrease the use of body muscles and made available a plentiful food supply; and this combination demands a careful adaptation of activity, of recreation and of rest in order that health be maintained at its highest levels. Sedentary life is highly unfavourable to vigorous health and this kind of life demands exercise that will compensate to the degree of inactivity. Sedentary life brings with it some real dangers to the vital organs and the earliest organ to suffer loss in strength is the Heart. Persons living sluggish lives have a low respiratory activity. The muscles themselves suffer indirectly from inactivity. Practically without exception such a person sooner or later pays the penalty by a degree of muscular flabbiness, which impairs his capacity for useful work and reduces the enjoyment of life. Nothing in the field of Hygiene has been more definitely established than the fact that muscular exercise is essential to health; and the general advice given is that every normal individual should take regular exercise, vigorous and general enough to involve the use

of the large muscles of the trunk and limbs, and pursued far enough to induce perspiration and stimulate circulation and respiration.

The force of the heart is spent largely in pumping the blood through the small arteries and capillaries, of which latter there are as many as 20,000 in a cubic millimetre of flesh, a piece that is the size of rather a large pinhead. To maintain the flow of blood from the capillaries into the veins little pressure is required; and the circulatory conditions are so arranged throughout the body that every change of posture and every movement of the muscles sends blood from the capillaries into the veins past the valves set in the veins for this purpose towards the heart. For example, if the fist is forcibly closed the skin blanches as the capillaries are squeezed empty, but the veins of the forearm are seen to fill; so also the skin pales under the influence of gravity when the hand is raised above the head. These facts illustrate the influence of activity and change of posture on the circulation of blood.

Exercise compels increased depth and rate of respiration and the result is more effective oxygenation of the blood, increased elimination of CO_2 and increased O supply to the tissues. By deep breathing the blood is well oxygenated. The respiratory movements and particularly those of the diaphragm act on the abdominal circulation, and when respiration is deepened by exercise a far more active circulation is maintained in all the organs of the body including the bowels, which are thus massaged as it were and constipation is thereby prevented,

Vigorous exercise increases the circulation through a particular part or through the entire body. This circulatory activity carries nutritive material to the tissues and removes from them the waste products of the body-metabolism; it assures the adequate distribution of the endocrine secretions and equalises water and heat-content of the body. This action helps to prevent and remove aches and pain from the body. In case of asthma training of the patient in deep breathing-exercises is most beneficial.

Exercise, we said, increases tissue activities and heat

production and stimulates the utilisation of nutrition from food and indirectly the appetite; and the increased circulation and elimination brought about by exercise influence the life of nerve cells and also improves the control of nervous and mental functions. This is an highly important factor in solving the difficult problem relating to nervous control. Hence suitable exercise does not only improve the body but the mind also, the brain becomes alert and active; and given a good intellect the man who comes to prominence in life is the man possessed of most endurance, one who can get on in life with perhaps less sleep and can do harder mental work and for more hours at a stretch.

This is an important economic health principle to be remembered by students and businessmen alike.

Now, as most of the energy of the food is spent in keeping the body warm exposure to cold by raising the body-heat production stimulates appetite; swimming in cold water has, therefore, greatest effect in increasing the basal metabolism tenfold. The breathing of cold air, moreover, enhances the evaporation of moisture from the mucous membranes of the air-tubes, the greater evaporation occasions more secretion from increased circulation of arterial blood through the membranes, and this means their better cleansing and improved resistence to infectious disease. In these facts and exposure to sunlight lies the success of open air-treatment of all lung troubles especially Tuberculosis.

Experience has shown that children, who live and sleep in the open air and are wellfed, clothed and exercised do not suffer from lung and other complaints, which children who live mostly indoors usually suffer from.

While seabathing and open-air life exert most potent influences on health a holiday at the seaside spent mostly indoors at cinemas and dances cannot be efficacious. Not only does cold moving air brace up the skin and so the whole body but the sun acting on the naked parts enhances vitality.

Exercise should be adapted to age, sex, occupation, climate and the individual himself. A great number of activities have

been made available, which produce satisfactory use of the body muscles, such as swimming, tennis, horse riding, hunting, fishing, gardening etc. Exercise taken from this group will be satisfactory for the average person though every one would be better off if some personal variation were made to suit his own needs.

After 40 years of age activities undertaken should only require moderate endurance and speed. The perils of middle age are a premature deterioration of muscle-power with a lowering of the functional efficiency of the important organs and systems. This can be avoided by a carefully selected regimen of exercise, either from the above named groups on a reduced scale or in a form best suited to the individuals' health. No exercise, whether physical or mental, should be carried to the stage of exhaustion.

The lighter skeletal frame work, weaker musculature, smaller heart, smaller lungs and shorter stature of women are sound reasons for adopting standards of performance in keeping with them. Types of activity should be prescribed suited to the needs and in harmony with the powers and functions of the female.

In this connection it must be said, that though in recent years the athletic girl has progressed so far and so fast that some people with more enthusiasm than judgment predicted a time when girls will compete on equal terms with boys, this can never be for reasons just mentioned.

3. Rest and Sleep

Rest is necessary after physical and mental exertion and is secured in varying degrees of completeness by reducing or moderating the pressure of one s physical, mental or social activities.

A change ot activity also can secure rest; the escape from monotony, the relief of one set of muscles by the use of another set, changing from one sort of mental activity to another or the transfer to a new and more attractive environment being a few of the means with which rest can be secured.

Physical rest of the voluntary muscles of the body is not only essential to remove muscular fatigue and restore the working efficiency, but influences directly or indirectly all the organs of

the body; and employees have found that periodic rest-periods in many industrial processes result in increased production.

Disturbing noises, repulsive odours, intense light, excessive heat or cold are examples of stress placed on the nervous system through the senses and contribute to the sum-total of fatigue, and demand rest. Practically all these sensations can be favourably modified by the individual by intelligent care. Beneficial results of such care extend to all the systems of the body. Eye strain can be reduced or removed by attention to proper illumination and correct habits of using the eyes with suitable periods of rest; the person whose sleep is not refreshing can frequently be helped by attention to light and noise conditions in his sleeping place.

The sources of mental rest may be found in a combination of interesting work, pleasing exercise, happy play, peaceful sleep, balanced nutrition and effective excretion. Most people are immensely benefited by practising the technic of mental as well as physical (muscular) relaxation. Improvement of the power of repose or tranquility by proper direction is not impossible.

Benefits of the quality of cheerfulness are a very useful source of mental rest, and interesting work or play are invaluable sources of mental rest.

Some of the signs of imperfect mental rest are constant movements of the limbs, exaggeration of unimportant details of life, groundless fears, anxiety, worry and constant mental excitement. Early recognition of these signs and the securing of proper mental rest may prove an adequate preventive against complete mental disability.

"Sleep" (Tired Nature's sweet restorer, balmy sleep) is a provision imposed by Nature to satisfy the living body's requirement for rest; it is the most perfect form of rest in which the receptivity and the reactivity of the entire system are suspended and the conscious mind rested.

Sleep is evidently a habit acquired by man through thousands of years when his activities of the day naturally terminated with the setting of the Sun, there being no artificial light known in the early days of man's history. That being so sleep should be considered a "bad" habit in these civilised

days when nightfall is no handicap to most occupations. This does not mean that we can do without sleep, a habit formed thousands of years ago cannot be given up at once, and lack of sleep is quite detrimental to mental and physical efficiency and to health. In fact lack of sleep for a long number of hours often gives rise to mental ill-health and might even kill much more rapidly perhaps than lack of food.

Sleep varies in depth and effectiveness. It is better to sleep well than to sleep long, an hour of the best quality is worth many hours of the worst. The ideal sleep is a comparatively dreamless sleep with a minimum amount of body movement procured in an environment with proper air, light and sound conditions and not terminated by alarm clocks or other external stimuli. Much sleeplessness could be avoided and a great increase in the benefits of sleep could be secured if we took greater care in providing favourable environment and proper mental preparation. Consideration should be given to the character of the bed and the bed room; proper ventilation and control of lighting and noise have much to do with the quality of sleep, even though the sleep does not wake.

Ideal size of the bed is a double bed for each person in order to encourage muscular relaxation and healthy posture. A narrow bed reduces effectiveness of sleep by apprehension of falling. Bed covers should be light and warm. The placing of bed so that the early morning sun does not shine on the face is worthy of attention.

The preparation of the individual for sleep is of equal importance. See that the stomach while going to bed is not heavy with late meals; as then you are apt to get night mares on going to sleep; proper restriction of fluid—intake late in the day will prevent disturbance of sleep from having to get up for passing urine. Mental attitude and emotion are often disturbing factors in wooing sleep. The putting aside of the tension of the day is the first requisite for restful sleep, and it is a wise plan to taper off the emotional tempo by quiet relaxation of the body muscles helped by properly selected reading or music. A warm bath or warm drink at bed time is conducive to sleep.

Of course this extensive ritual is not ordinarily required for inducing sleep in the average normal individual but is helpful in combating some forms of sleeplessness.

Experiments have proved that the normal person who sleeps on an average 8 hours in 24 hours is less efficient when he is deprived of even 2 hours sleep, and that after an all-night sitting it may be two or even three days before he is able to recover his normal efficiency and capacity for work. But, it has been found that one can manage with much less sleep than 8 hours if he sleeps better, and that the man who usually has that amount of sleep (8 hours) is not better off in the matter of efficiency than one who sleeps only 6 hours or even less but more "intensely." Bismarck, Napolean and the great Akbar, all had only 4 hour's sleep in the 24 hours, but they must have slept intensely. In fact, Napolean is said to have prided himself on his ability to go to sleep "at will" and wake up "at will" also. This remarkable capacity is a natural gift due, it is said, to their ability to ' make the mind blank," whereby all extraneous disturbances to sleep, viz. light, noise were quite ignored.

In recent times we have instances of short sleepers in the great Edison, Poincare and Lloyd George, who have shown that it is possible to sleep little, yet be fit physically and mentally. The secret of these short sleepers is said to be their physical and mental energy and their arduous love of work, which makes every day seem to be too short.

4. Clothing

Clothes have entered into the very core of our existence as social beings, and there is a general agreement upon the fact that clothing is used for three main purposes—of decoration, of modesty and of protection. The impulse of modesty and the urge for decoration even though frequently conflicting have contributed much to our present attitudes and habits with reference to clothing. It seems clear that in some ways these two motives are opposed to each other; for, the essential purpose of modesty is to hide such excellences of body as we have and

refrain from calling the attention of other people to them; while the essential purpose of decoration is to beautify the body so as to attract the admiring glances of others of the same sex or of the opposite sex. It would seem impossible to satisfy these two contradictory tendencies by means of clothes. However, the tendency for both display and shame are attached not to the clothed body but to the naked body.

The decorative uses of clothing are many and varied. The one given the greatest prominence is sexual. Primitive clothing and decoration started at or near the genital region and frequently related definitely to some sexual occasion, such as puberty, marriage etc. The modern purpose of clothing adds to sexual attractiveness, stimulates sexual interest and arouses the envy of rivals of the same sex.

The protective purposes of clothing are commonly considered the most important. Originally they were secondary to adornment and modesty. Accidentally, their advantages in protecting the body against cold give them a prominent place. This seems more rational and so we often find the motives of modesty and decoration hiding behind the more utilitarian motive of prctection.

Under modern conditions the proteciion of the body against cold and direct rays of the sun is among the most important protective functions of clothing, such as guarding the body against external enemies, whether by armour or through protection against insects and animals.

From the hygienist's point of view the protective function of clothing ranks first; its physiological usefulness in regulating body temperature, protecting the individual against unfavourable external influences and conserving energy makes clothing an important instrument in the maintenance of health.

Man is a warm-blooded animal; continuance of life requires that the body temperature is maintained within certain critical temperatures. Effective function demands that this range of internal temperature varies only within very narrow limits. The most suitable temperature for maximum activity of the body cells is approximately 98.6°F. Hence both in warm and

cold surroundings the body must maintain a uniform temperature, which means an accurate arrangement for heat regulation. This is accomplished by controlling the production of heat in the body or loss of heat from the body or both.

Heat Production. The primary sources of animal heat may be found within or without the body. Heat production occurs wherever metabolism (tissue-activity) takes place, more heat being produced in more active organs and tissues, muscles and glands. Four-fifths of the output of the body-energy is concerned with heat production, 80 p. c. of food eaten is consumed in the cells to make heat; activity of the thyroid, bodily exercise or friction of body increase it and to a small extent the ingestion of hot foods and fluids. Climates of high temperature or external applications of heat to the surface of the body may impart heat to it as the blood at the surface carries the heat throughout the body.

Heat-loss is due to both radiation and conduction as well as to evaporation of water. Radiation and conduction of heat from the surface of the body are controlled by variations in the blood flow through the skin. As the surrounding temperature approaches the body temperature heat-loss by radiation and conduction becomes increasingly difficult, and from this point on evaporation of water must be depended upon, and evaporation is the largest, single factor in heat-loss. The avenues by which this loss occurs are the surfaces of the mouth, tongue, pharynx and the lungs; and through the activity of the sweat-glands sufficient moisture is furnished for evaporation and heat-loss, unless there is some serious interference with the nervous and circulatory and physical path-ways.

Maintenance of a Uniform Temperature. Since we live in an environment of constantly changing temperatures we require a delicate adjustment between heat-production and heat-loss. Now clothing is one of man's most significant contributions to the control of his environment. Many of our most curious errors in the use of clothing are due to a failure to recognise the fact, that clothing does not create heat but merely diminishes the rate at which the heat (produced in the body) is lost.

Hygiene of Clothing. From the hygienic point of view good clothing should be such as ministers most satisfactorily to the needs of decoration, modesty and protection. Generally speaking, the aged and the infant need more clothing on account of the fact that the temperature —regulating mechanism is feeble in the one and not fully developed in the other. Care must, however, be taken to avoid the habitual use of much clothing by the infant lest he become sensitive to external temperature changes. On the other hand, exposure to sudden changes of temperature may result in Gastro-intestinal or respiratory disorders. Except in mild climates the infant should be well protected from heatloss by wool or silk and wool under garments. External clothing should be adapted to the external temperature changes. The clothing should not cause sensible perspiration under normal conditions.

As the child gets older the clothing should be reduced to a minimum compatible with comfort. While the sensation of "feeling cold" is not quite a safe guide in all cases it is a useful guide in the case of children. We are fortunately losing our passion for over dressing children. Clothing that gives a maximum of freedom of movement and optimum exposure to Sun's rays has proved to be hygienically sound and conducive to health.

Seasonal adaptation. The balancing of heat-production and heat-loss at various seasons of the year needs special attention. External temperature lower than the body temperature requires provision for adequate production of heat by the body and satisfactory heat retention. This should be accomplished largely by change of external clothing. When the external temperature is higher than that of the body the function of clothing becomes reduced to only protecting the skin against sun and dirt and satisfying the accepted standards of modesty, and decency. All excessive clothing (not required by decency) should be abandoned.

Absorbent underwear and loosely woven outer garments in light colours make up the sensible hygienic outfit.

Materials of clothing and characters. The vegetable kingdom furnishes us with cotton, linen and wood fibre (artificial

silk), while from animals we get wool, silk and furs. Genrally speaking, those from the animal kingdom are warmer. All of these materials are classified according to their power for conducting heat away from the body and absorbing moisture.

Wool stands out for its qualities of warmth and absorptive abilities. No other material has these qualities to such a degree as wool. Linen ranks next, while cotton and wood fibre follow in order. Keeping the body dry by absorption of sweat with slow evaporation is a valuable quality possessed by wool, and silk resembles wool in this respect.

Texture of materials from which clothing is made is a determining factor in its usefulness for heat regulation. Those materials that are poor conductors of heat contain much air in their meshes. Dry air is a good conductor of heat, wool is a poor conductor particularly when loosely woven and is consequently warm. Silk and cotton may be woven so as to be much warmar than usual. Khadder is a loosely woven fabric of either cotton or wool and is therefore a bad conductor of heat and keeps the body warm. It is cheap, durable and most fashionable as is the fashion of the day in our Country and combines the three qualities in one.

Clothing should not be too heavy, thickness does not necessarily mean warmth. The air-content and texture are of more import. Several layers of light garments of proper quality are superior to a single heavy one.

Dark coloured fabrics absorb more rays of heat and are useful in the cold weather; while in the hot weather and hot countries light colour fabrics are useful.

The way clothing fits should be guided by its relationship to body function rather than style. Clothing should not hamper breathing. It does not suffice to breathe pure air, it must be properly breathed. The abdominal organs with their important functions must not be cramped or their circulation impeded by tight clothing.

The system of wearing a tight belt or girdle round the waist among our women is a common cause of indigestion and constipation and displacement of pelvic organs in the same way as tight-lacing had been in the Victorian days in England.

Body posture has much to do with adequate physiological function. Styles of dressing having a tendency to bring about "poor posture" through their weight and pressure should be avoided, as "poor posture" means inadequate functioning of all the important systems of the body. Constrictions and pressure may be caused by belts, vests, corsets and garters. Improperly fitting shoes or shoes with narrow tips though very stylish in themselves are not comfortable and interfere with walking and cramp the toes on each other. In-turning of the nails of the toes is always due to the use of narrow tipped shoes. Tight hats, stiff collars and neckbands are also harmful if they do not fit properly.

Force of fashion in dress. Fashion is said to be a mysterious goddess whose decrees it is our duty to obey rather than understand; one may either be a worshipper of fashion or a scoffer, neither attitude becomes the scientist. So we enquire why fashion exists and what are its influences on humans from the hygienic standpoint. The ultimate and essential cause lies in social and sexual competition. Born of an innate desire for the recognition of superiority it has become an economic as well as psychological problem. The desire to be equal to our fellow men leads to imitation at any cost Lower social ranks seek to move away from their former position. This operates on the community as a whole and on each individual.

Commercial organisations recognising these facts have built up immense interests for mass-production and rapid and frequent changes in style. The tempo of life leads to acceptance of rapid change expressing itself in changing tastes in clothing. Our fear of not being up to date does the rest even at great sacrifices.

In certain types of people to be denied clothing according the prevailing fashion is sufficient to cause reactions that spread their influences to almost any system in the body. Fashion may cause the individual either to overdress or to go without sufficient dress to the detriment of his health.

In certain mental states fashion in clothing is a most important consideration in adequate treatment.

Spencer has wisely said "a consciousness of being perfectly

well dressed may bestow a peace of mind such as religion can not give". So the individual, be he a child or adult, who is made to feel a sense of inferiority on account of clothing not in keeping with his own social position has a serious source of psychologic irritation. The results are often far- reaching.

5 Personal Cleanliness

Cleanliness of the mouth is of special importance in our Country. Pyorrhoea is a common affection in the tropics and not infrequently results from neglected dental hygiene. The teeth should be thoroughly cleaned with a brush of some sort. Any part of the teeth where the food constantly lodges is likely to decay sooner or later as this ferments giving rise to acidity which has a corrosive action on the enamel and dentine of the teeth and leads to dental caries. Hence, it is necessary that scrupulous cleanliness of teeth should be observed. Deposit of tartar should receive attention and the teeth have to be "scaled" otherwise they will decay and fall. Children's teeth require proper attention also. It will be shown later that the commonest cause of dental caries in children is excessive use of sweets, chocolates etc. which lurking in between the teeth acidify and begin to act on the new dentine and enamel of the teeth,

Washing the hands and feet before saying prayers or before meals has no doubt its origin on the hygienic effect of keeping the hands and nails clean. Biting the nails is, of course, an uncleanly habit and particularly dangerous in the tropics, as intestinal infections such as hookworms, round and thread worms, cholera, dysentery are very likely to be carried in this manner.

In the Tropics especially there is a constant danger of contracting some forms of skin-disease—such as dhobi-itch and barber's itch—through clothing, hair-combs, shaving razors and shaving brushes. Each man must have his own shaving set and should not depend upon the barber however clean his kit be. Soap should always be used for a shave as soap is a good dis infectant and prevents conveyance of skin disease and even the

syphilitic poison. Hair brushes and shaving brushes have spread anthrax and have to be carefully disinfected before use.

6. Marriage

Certain questions regarding marriage in our Country especially deserve our attention from both economic and hygienic considerations, as they relate mostly to our social customs, such as Infant-betrothal, infant-marriage and marriage among blood-relations. Luckily the first two customs are at present things of the past since the passing of the Child-marriage Restraint Act of 1928—The Sarda Act—by which no person, if a male under 18 years of age and if a female under 14 years, can contract marriage.

The disadvantage of infant-betrothal is that not only are the parties to the marriage disposed of without being themselves consulted but in the long interval between the betrothal and the actual consummation anything is possible, and disease or other circumstances might render one or other of the parties quite unsuited to married life; moreover, consummation of the marriage at a very early age is also encouraged by the practice, and if the girl becomes a widow religion demands that she be condemned to perpetual celibacy, all through her life.

From a purely physiological point of view also early marriage is to be condemned for the reason, that sexual indulgence in either sex before their physical development is complete, is disastrous to health, it causes lack of manliness and vigour in the male and it exposes the immature female to the dangers and risks of pregnancy and parturition; and a mother who has to provide nutriment for herself as well as for the baby inside her is likely to prove unequal to either task; the result is that the children born of such mothers are less robust and less vigorous than those born of mature parents. Infact one cannot imagine how an immature girl of 13 or 14 can bring into the world a strong and healthy child. Child-marriage with poor food, repeated pregnancies, are the potent cause of still-birth and infantile mortality, and is one of the most important causes of degeneration of the race. No wonder there is no country in the

world where still-births and infantile mortality are so high as India.

It has, however, been urged in favour of early marriage that the suppression of the sexual function must have a bad effect on health and that, therefore, marriage should take place in both sexes even at puberty. This argument seems to be based on a wrong assumption, as statistical evidence goes to show that the mortality among those married before the 20th year is very high in both sexes. In fact no girl can be said to be fully mature or developed before she is 18 and no man before he is 20. Even the great Manu, the Hindu Law-giver, states that the male should marry only when he has become a "**grihastha**", that is at 24, and the female at puberty that is at about 14. No girl, therefore, who has the good of her country at heart and of her progeny and race should marry before she is 18 and no man before he is 20.

"**Improvident**" marriage is of importance both from economic and sanitary stand points. In countries where early improvident marriage is the rule not only are marriages numerous but the number of children born to each married couple is much larger than in countries where marriages are contracted only later in life, when provision has been made for the care of the children. The population in the former case tends to increase more rapidly than the means of subsistence and it is naturally reduced by the "misery check" of famine and epidemics. This is the case in India; whereas in countries like Britain where provident marriage is the rule, the population increases more in proportion to the means of subsistence and is less liable to be "thinned" out by famine and disease. Where marriage is limited to parents of mature age also even though fewer children may be born they are better cared for and fewer will die so that the infantile death-rate is diminished.

The voluntary "prudential check" to increase in population in the shape of provident marriage is, therefore, a wise and efficient means of guarding against misery and death.

Generally speaking the prolific early-marrying race is likely to be less provident, less vigorous, less wealthy and therefore much more easily affected by the "misery check" than the later-

marrying race, who adopt voluntary prudential check. The same rule holds good in individual families.

Intermarriage of blood-relations (Consanguinity of marriage) is often objectionable because the children born of such parents have a double (one from the mother's and the other from father's side) chance of inheriting any family weakness or disease that may have existed among their ancestors. A neurotic temperament or a tendency to bodily or mental disease is thus more surely inherited. Cretinism is said to be favoured in this manner and the risk of certain hereditary forms of paralysis, congenital deaf-mutism, retinitis pigmentosa with night blindness, epilepsy, insanity and still-births is said to be furthered. Further intermarriage within the narrow circle of blood-relations is a fruitful cause of social degeneration and decay. It is said that the East-End Londoners who intermarry among themselves, all practically members of the same family, do not see the 4th generation. They die out without leaving any issue unless they go out and marry from the country and thus bring fresh blood into the family-stock.

On the other hand if the family be a vigorous one and a healthy one the intermarriage of relations may increase desirable traits in the offspring. This principle is well-known to horse and cattle breeders and to dog owners.

Who should not marry and why? There are certain well defined conditions under which it is objectionable to marry:

(1) when the married state and its contingencies would jeopardise the health and perhaps the life of the person, as in cases of grave disease of the heart, of the lungs or of the kidneys, and of greatly contracted pelvis. In such cases death might be the consequence of the marital act or pregnancy or child-birth.

(2) When the person is suffering from a disease likely to be transmitted to the spouse or children, such as, syphilis, leprosy etc.

(3) If the person is suffering from an actively infecticus disease like Tuberculosis, marriage should be strongly protested; but whereas in the case of epileptics or diabetics there is no risk of infection and some of the children may escape the

transmission it is advised against marriage on the ground that some at least of the children would almost certainly inherit the disease.

(4) In the case of epileptics, alcoholics, opium-eaters, imbeciles it is quite essential that marriage should be prohibited as most certainly in such cases a neurotic class of progeny is the result. Gout and Rheumatism are two other conditions usually transmitted to the children, but are not necessarily contra-indications to marriage as the hereditary tendency can be overcome by an environmental change and good habits of living.

We know the instance of a medical friend who died before the 35th year leaving 4 children—all imbeciles, having been begotten after he contracted the habit of taking morphia, which drug he took in 3 or 4 grains doses hypodermically to give sleep at night as he was suffering from sciatica. Most of the children died before the 14th or 15th year.

7. Sexual Abuse

Excessive sexual indulgence is harmful enough in adult life but much more so in youth. It gives rise to general nervous depression with mental and muscular weakness and results in premature loss of sexual power, premature old age and often melancholia and other mental disorders. Sexual abuse in the married is the result of ignorance of its bad effects; in the young and the unmarried it is often encouraged by obscene literature' bad company and the lures of prostitution. This is one reason why it is advocated that even young children should not be denied knowledge about sex matters. In fact children cannot be brought up in ignorance of sexual matters and sexual passion and they must be told the need for controlling that passion. This will sooner help them in avoiding the evils of abuse. There is no danger in continence but there is great danger in sexual excess. A certain amount of exercise daily, a non stimulating diet giving a daily action of the bowels, chastity of thought and avoidance of stimulating literature or pictures will render continence easy and keep the body and mind in a vigorous and healthy condition.

8. Civilisation and Health

Even the primitive man recognised the importance of fresh air, of sunlight and of pure water for his very existence and worshipped the Elements, the Sun and the Rivers as his Gods. At first he lived an itinerant sort of life fixing his temporary abode in open space preferably near rivers and springs and moved on to a fresher and cleaner spot when the original habital became too unclean. He thus lived practically in the open air and sunlight with his body bare and drank pure water; his food was of the simplest kind and fresh and consisted at first of fruits and nuts which Nature yielded, flesh of animals which he hunted, fish and fowl, and latterly of cereals and milk when he learnt the art of cultivation and kept cattle and sheep. He worked hard in the day. This gave him appetite and enabled him to digest his food, build his muscles and vitality, secured him the night's rest, made him immune to the ravages of the elements and to disease. In fact his was a happy life, disease was practically unknown to him and premature death even from child-birth was rare, and he lived to a ripe old age.

But with the advent of civilisation and culture instead of "advancing unto light" he gradually receded from it. At first he excluded light from his body by clothing it, next he built houses in which he spent most of his time sheilding himself and his effects from light. Thus, from the broad day light of the farm and the forest he led himself "into the shadows of darkness" and when he built the modern city with its cramped houses, narrow streets and sky scrapers he made direct sunshine a comparative stranger. Finally, when with the development of industries and increase of manufacture and consequent rush for Town-life the atmosphere became impure, laden with smoke, dust, dirt, toxic gases and fumes, the most vital and all energising rays of the sun were practically shut out from him. Constant breathing of such an atmosphere lowered his strength and working efficiency, his vitality, his well-being and his power of resistance to disease. Rickets, Tuberculosis, Heart disease, were the inevitable result. While the effects on the body were bad enough those on the

mind were worse as "gloom without made for gloom within and induced mental depression."

Man next developed a new taste, an appetite for the pleasures of the table. From the fresh and natural food of his early days he slowly went on to refined foods, seasoned foods, artificial foods and preserved foods—all these are devitalised foods and deficiency foods in the extreme; and took to tea, coffee and liqours—"ales stronger than Adam drank," and smoking. Such life coupled with sedentary habits, excesses of various sorts and late hours of clublife rendered possible by the discovery of electric power and light, upset his digestion, interfered with his rest and rendered him liable to dyspepsia, liver abscess, gout, Rheumatism, Diabetes, Bright's disease, High blood pressure, cancer etc. Venereal disease slowly crept in, in fact, it has almost become a truism to say that Syphilisation was concurrent with civilisation. The sweet pleasures of the table have after all led to bitter griefs of life.

Lastly, the speed, the stress and keenness of competition of modern industrial and social life shattered his nerves and rendered him unable to stand the strain of civilisation; the result was a general mental weakness perhaps verging on insanity with its suicidal and criminal tendencies.

Thus, paradoxical as it may seem, the blessings of civilisation have given rise to an immense increase in the suicidal rate, new forms of disease of the body and the mind, growing social unrest and a tendency to revolt, a spread of crime, unemployment and poverty and want. The most cultured communities are foremost in spending large sums of money on alcohol and narcotics; and the habitual use of these can generally be traced to the anxiety, stress and worry inseparable under present conditions from civilised living. Material prosperity is largely illusive and life itself is often sacrificed in its attainment.

Now, mental deficiency is generally an inherited misfortune and is unfortunately on the increase in higher civilised countries, where an enormous number of feeble minded and neurotic individuals, men and women, are at large free to propagate their "Kind" in wedlock or otherwise. Most of these are

without moral sense, lacking in conception of right and wrong, and are quite untrainable in moral behaviour. They have a tendency to commit serious as well as minor offences of a criminal nature. Among them there are obsessional train-wreckers, who place obstacles on Railway lines and stand by to watch the derailing of trains and destruction of life enjoying the excitement of the disaster with a Sadistic Zest (a love of cruelty); impulsive incendiaries, (who maliciously set fire to property) pyromaniacs (setting on fire any thing, even houses) and mischievous aments (deficient in mind) possessing a morbid desire for maiming animals or showing cruelty to them in one way or other.

While, then, our present outlook is so full of menace to the individual, the society and the race our future outlook will be apalling so long as we continue "to breed as cavemen bred, automatically and instinctively" and without thought or regard for the future generation. We may take pride in the "applied science" that enables us to conquer the air, to converse with an acquaintance thousands of miles away, to beat the record of speed in locomotion and to manufacture gases of modern warfare which can annihilate the enemies' camp in no time; we may also excel in scientific breeding of horses and cattle, dogs. rabbits and poultry but the production of a superior human race we leave only to chance. The average citizen gives little or no thought to humaniculture, that is, production of men and women efficient for industry, social responsibility and healthy parentage. This of course is a subject by itself and does not concern us more in this connection.

Now, however gloomy the above picture be there is Science, which has been growing steadily with the advancement of civilisation, there is religion, the outcome of an age—long experience, there is the code of Ethics with its "do"s and "dont"s, there is common sense, which all human beings are expected to have and above all the efforts of hygienists—all these come to man's rescue and lead him to a new realisation, that of a "happier life.'

9. Liqour-Habit

Alcohol is esteemed mainly for its effects on the Central Nervous system; for, in suitable doses it "relaxes the rigid self-control and discrimination which inhibit the full enjoyment of congenial company".

Alcohol does not require digestion, and being soluble in water and readily diffusible is rapidly absorbed into the system. Infact, absorption of alcohol begins in the stomach itself; this is the peculiar feature of alcohol as no other food-elements are **absorbed** from the stomach; it then enters the blood and diffuses through the tissues and organs such as the Brain, Liver, Kidneys etc. and even after a moderate dose the drug can be detected in the sweat, breath and urine and in the case of suckling mothers in the breast-milk.

No sooner absorbed than it is quickly oxidised like fats and carbohydrates yielding heat, CO_2 and water. In this sense it is often called a "food"; but it cannot be transformed in the system into fat or glycogen as other food elements like sugars or starches can be, and hence they cannot be stored in the body. Moreover, unlike "food" proper alcohol is "toxic" or poisonous to the cell-protoplasm. Thus, it has been found by experiments that 1 part of alcohol in 100 parts of water killed cress seeds, while 1 in 10,000 solution (equivalent to one drop in one pint of water) retarded their germination. Even the yeast plant itself which produces alcohol is killed by its own product after the strength of alcohol has reached beyond 12 p. c.

Alcohol may, however, indirectly cause obesity; first, by increasing the appetite and favouring over-eating, and secondly by "sparing" the tissues especially fatty tissue, as the oxidation of alcohol in the body, lessens the need for the oxidation of fats or carbohydrates. Thus, fat is spared to be stored as such, or the carbohydrates spared to be converted into fat.

When alcohol is absorbed its "concentration point" is reached in the blood within a short time. Now, the degree of intoxication depends upon this concentration in the blood at the time, so that if a person intends to consume a large quantity of

alcohol whether in search of pleasure or of energy but is at the same time particular in minimising its intoxicating effects also, he could do so by adopting certain means that will delay the rate of absorption. Now the chief factors known to retard the rate of absorption of alcohol are:

(1) The presence of food in the stomach, especially such foods as milk, bread and fatty substances; and (2) Dilution of the alcohol. Hence even the mildest of alcoholic intoxicants taken on an empty stomach produces maximum effect. Hence the usual practice of starting a meal with a high content of oils or fats such as soups before the "drink" is conducive to the retention of a "discriminating palate" throughout the course of the meal.

The quantity of alcohol required to produce its intoxicant effects varies enormously according to its dilution and strength, the previous habits of the individual and his idiosyncrasies (individual susceptibilities); and, as pointed above, on the presence or absence of food in the stomach at the time of drink and the degree of concentration in the blood.

Ordinarily about $\frac{2}{3}$ ounce is sufficient to produce detectable amount of inco-ordination (reeling etc.) and a blood-concentration of 0·15 p. c. is about the order of concentration that corresponds with "drunkenness" in a person **not addicted** to alcohol. The degree of intoxication, then, depends upon the blood-concentration so that "lethal concentration" may be said to have been reached when alcoholic "stupor" has set in.

After a variable time the blood-concentration will gradually decrease until the body is practically free from alcohol. Mellanby has calculated that it takes 3 or 4 hours for the body to get rid of one ounce of alcohol and about 10 to 20 hours in the case of a "heavy drink".

Now, it is a matter of common experience that a person **not accustomed** to alcohol is more readily affected than the habitual addict. Schweisheimer showed that if total abstainers, moderate drinkers and heavy drinkers imbibe the same quantity of alcohol under the same conditions of dilution and time with relation to food the resulting blood-concentration of the alcohol is the highest in the case of abstainers and lowest in the habitual

consumers. Habit perhaps explains this difference by producing tolerance for the drug or may be some unknown protective power is developed to guard against lethal concentration, evidently by lessening the power of absorption of the stomach mucous membrane, which in an addict shows always signs of chronic inflammation with thickening and consequent atropy of the digestive glands.

There is a similarity of action between the effect of sugars on the diabetic and the effect of alcohol in the normal individual. The diabetic can dispose of absorbed sugar only through the kidneys and the normal individual can dispose of his alcohol only by oxidation; but in both cases the mechanism of disposal is effective only to a certain limit of consumption, beyond which increasingly disastrous results do ensue even to the point of death. In either case, therefore, the regulation of the composition of the blood, is largely a matter of voluntary control. The diabetic, however, is aware of his danger and exercises his voluntary control over his dietary, but the same thing cannot be said of the alcoholic as he has no self-control whatever over his drink.

The property of quick oxidation exhibited by alcohol in the system and its capacity to thus spare the tissues of the body from waste are taken advantage of by physicians in the treatment of certain febrile conditons attended with exhaustion and low muttering delirium—toxoemia as of typhoid fever, pneumonia—and alcohol usually prescribed as brandy; the effect of alcohol, however, in such cases is only temporary by stimulating heat production and the action of the heart thus enabling the patient to "tide over a crisis", and alcohol does really so enable; infact, even in the case of "delirium tremens" caused by prolonged addiction to a large quantity of alcohol the very cause, alcohol, that has brought about the condition serves to effect a cure in extreme cases.

The popular belief that alcohol prevents "catching cold" is altogether unfounded, and must have been built on the theory that alcohol increases heat-production by itself serving as fuel. On the other hand alcohol causes the bloodvessels of the skin to dilate, large amount of perspiration thus results, by the evapora-

tion of which the body loses heat rapidly. This loss of heat necessitates the body to oxidise more food to make good the lost heat and the body becomes thus overworked or fatigued.

Physiology teaches that when the vital forces are exhilerated and made unnaturally active by the use of such drugs as alcohol, this over-activity is invariably followed by a corresponding degree of depression of the Heart and the Nervous system; and to "keep the spirits up" the addict "pours more spirits down" his throat. Habit is, thus, readily established.

It is common experience that some persons, especially those in vigorous health are able to stand a surprisingly large amount of alcoholic liquors with comparative impunity—but, whenever a test can be established it will be seen that those who have **habitually refrained** from all such stimulants, other things being equal, will undergo fatigue and hardship, which those accustomed to these stimulants but who may not have shown signs of having been affected thereby, will be **unable** to endure.

The addict, therefore, who takes to more drink under the mistaken notion that he increases thereby the production of heat to guard against external cold does so at very great risk indeed, as the reactionary depression following the stimulant effect renders him readily liable to catch a much more formidable disease than cold, viz pneumonia, dysentery etc., and the chances of recovery from these affections are especially remote in the alcoholic with his run-down constitution.

Dr. Nansen, while at a dinner of medical men and scientists was asked if he took any alcohol with him when he went on his Arctic Expedition, and his reply was, "No, if I had done so I should have never returned."

We have seen that small doses of alcohol do increase the flow of the gastric juice, but this increase is always followed by a decrease in the flow after the stimulation has worn off, and in course of time the gastric glands cease to work without the presence of alcohol. Again, we see that habit is established in this way too. Long addiction, therefore, gives rise to chronic dyspepsia from irritation of the delicate mucuous membrane of the stomach and the intestines and causes damage to the liver,

the kidneys, the heart and the blood vessels.

The common idea that alcohol aids digestion is quite wrong; on the other hand, experiments have proved that the efficiency of the digestive juice is actively interfered with, producing certain vague symptoms called Indigestion, Biliousness etc. Alcoholic dyspepsia is unlike any other form of the condition peculiar in itself, as it is the only cause of "morning sickness" in the male.

The action of alcohol on the muscle-cells of the heart is of a destructive nature, the muscle being converted into fat (fatty degeneration); this interferes seriously with the contracting power of the heart-musculature, and blood cannot consequently be forced along the blood vessels at the proper rate. Fatty degeneration of the heart it must be mentioned, is the most dangerous of heart-affections, and the affected individual may drop down suddenly dead without in any manner showing previous signs of heart disease or even without the patient himself being aware of the condition. The blood vessels may also be affected by long use of alcohol; they become inelastic and rigid like "pipe-stem," their lumen gets thinner, blood pressure is apt to rise; and this combined with the fatty degeneration of the heart is especially dangerous ,producing angina pectoris (agonising pain in the region of the heart) or cerebral apoplexy with paralysis, coma and death.

Alcohol does not prevent malaria unless the blood-concentration of the drug has reached the point of saturation at which stage "no self-respecting mosquito will come to bite such an individual."

Overindulgence in alcohol saps the vitality of the individual, especially the white residents of the Tropics and predisposes them to diseases like Dysentery, Pneumonia, Tropical liver-abscess, heatstroke or heat apoplexy and Tropical neurasthenia, and lessens also their chances of recovery from these affections; and confirmed alcoholics form very bad subjects for surgical operations, worse perhaps than even diabetics.

Obesity, diabetes and other metabolic disorders like gout etc., can also be traced to excessive and prolonged use of alcohol.

Mortality-records of Insurance companies furnish information for determining the effects of alcohol upon the resistance of the body against disease, and it is seen that nearly 42 to 45 p. c. of applicants are rejected for causes connected with the use of alcohol; and regarding actual deaths, it is seen, that as much as 95 p. c. of drinkers died before the stipulated time, whereas among non-drinkers the death rate was only 70 p. c. This is clear proof, then, that the use of alcohol shortens man's span of life.

Longevity can therefore be said to depend upon the Live—r.

The intimate relation that exists between drink and sexual excesses has long been recognised, and that sexual excesses are a fruitful cause of the increased prevalence of venereal disease in a community. We have already seen that excesses of any sort are distinctly a drain on the human vitality, and it is common knowledge what havoc does venereal disease work on a nation and their progeny.

The effect of alcohol on the Central Nervous system is to successively weaken and suspend the hierarchy of the Brain and therefore of the mind in the order from above downwards, the most developed functions becoming affected first, especially the finer movements of the hand; next, the higher mental powers such as judgment, self-control and self-criticism are affected.

Alcoholics are, therefore, as a rule weak-minded and fall an early prey to the drink-habit itself. Drink, then, predisposes to feeble-mindedness, and feeble-mindedness in its turn leads on to the drink-habit, a sort of vicious circle is thus established.

Alcohol, thus, produces a deleterious effect on the mental powers also. It is said that Prof. Huxley, the great physiologist who was not a total abstainer and might have therefore been friendly to the effects of drink, was once asked if he found alcohol a brain-stimulant; to which he replied, "when I have to do good or original brain-work I always decline to have it, I become a total abstainer for the time being."

Employers have long recognised that the habitual use of alcohol by workmen lowers their efficiency, and the recognition

of this fact has led employers to draw up rules prohibiting the use of alcohol during the working hours; others have gone further even to the extent of refusing admission to those who take alcohol in any form, at any time or in any quantity. This is particularly important and justifiable in employments in the Railways and other Transport Companies, where lives and safety of passengers are especially dependent on the clear-headedness of the employees.

Experiments have been carried on to test the effect of alcohol on the working capacity of workmen, which was found greatly reduced in the case of those who took to alcohol.

Dr. Richardson, who carried out experiments on himself concerning the effect of alcohol on muscular activity says: "The work that can be done during entire abstinence is superior in every respect—in respect to amount, in respect to readiness of effort, in respect to quality, in respect to endurance and in respect to mental ease and happiness."

Another experiment determined the effect of alcohol upon one's "speed" in responding to certain stimuli; the reaction-time was much longer in the case of alcoholics. Now, this reaction-time is very important when a quick decision is needed in cases of emergency, say avoiding a collision with an automobile or in running machinery of any kind. Since alcohol makes it impossible for a person to act quickly it is easily evident that it slows up one's rate of work and might expose an individual to any danger at a time when quick thinking and quick action are necessary.

One can, therefore, imagine that a motorist, for example, under the influence of alcohol is perhaps the greatest menace to public safety, and many of us do still remember some of the worst accidents that happened in Madras a few years ago.

Accuracy is an important factor in many lines of work especially those of a fine order, and experiments have shown that alcoholics were rendered liable to thoughtless or wrong judgments, which seriously interfere with their efficiency as workmen.

Human society has built up through ages certain rules of

proper conduct and ethics and ideals of right and wrong, and man has developed a will-power and power of self-restraint. These all form the requisites of a good society; and alcohol by paralysing the nerve-centres in man dulls his power of discrimination between right and wrong; and the effect of long continued habit is a complete breaking down of those refinements which modern civilisation has built up, resulting in moral degradation.

It has been proved beyond doubt that alcohol is not a necessary element for health and that those who take to it do so only for its exhilerating and appetising properties. Small quantities of wine or beer taken with meals may not produce any harm, and if this ration is not exceeded one may be considered, they say, a "moderate drinker." But, the phraseology "moderate" is rather a vague one as one man's meat may be another man's poison; moreover, there cannot be any definite line of demarkation between "moderation" and "excess," as moderation in the case of habit-forming drugs unconsciously and most certainly leads to excess, and such is especially the case with alcohol.

Man was not born with a craving for drink. It is an acquired taste under the belief that it is a stimulant, but the stimulation of alcohol is the worst enemy of the human race; and we have already seen that its effects on individual health are disastrous and more so on the health of the progeny, not to mention the moral and social degradation that its use entails.

Nations long addicted to alcohol count perhaps the largest number of idiots or imbeciles among their progeny, and neurotic individuals whose nervous system has become so shattered that they can hardly stand the stress of civilisation. America is such a nation to day, and although she has for some time practised temperance—lately however, she has gone "wet" again—the neurotic temperament which her present generation inherited from their wet forefathers still continues to play its havoc and explains the existence of perhaps the largest number of criminals or lunatics among her population. Yet the economic prosperity and moral wellbeing of America are said to be mainly due to prohibition.

The loss to national wealth by way of ill health, lowered racial vitality and incapacitated labour arising from the drink-evil is unimaginable, nor does the evil stop with the individual. It passes down, we have seen, to his progeny, causes family instability and wrecks his economic existence. The children of such parents are bound to suffer by reason of inherited neurosis or venereal disease and consequent germinal impairment, or poverty and want of proper care on the part of the parents in bringing them up. Such children cannot make useful citizens and members of a decent society, their ruin is ensured by the folly of their parents.

The effects of the drink-evil on a nation cannot be better expressed than in the words of a great British Admiral who said, "alcohol cut through the efficiency of Nations and weakened their fighting forces; one great cause of the early reversals of our Allies in the Great War of 1914 was the alcohol and tobacco habits of the Nations.',

Is Drunkenness inherited? In other words why is it that drunkenness is often noticed generation after generation in the same family? Is not this obviously because a man who first gave way to drink passed on the evil habit by inheritance to his descendants? This sounds common sense but it is not the real explanation. In the first place a son is apt to imitate his father, and the mere fact that a father drinks is likely to increase the chances of his son also doing so. Secondly, the first drunkard in any family may have inherited from his ancestors some hereditary weakness which made him especially ready to give way to this temptation among other forms of temptation, and he may have passed on this weakness to his descendants; a weakness which made them also in their turn especially liable to become drunkards. These are the real reasons why drunkenness sometimes runs in families.

The history of the evolution of the alcoholic beverages and how the drink evil spread makes an interesting study. The savage tribes were all water-drinkers when they were first discovered and conquered by the civilised nations. Thus, the Australian tribes, even the Hottentots and North American Indians

had evidently been ignorant of the art of preparing fermented drinks, because it is difficult to believe that an indulgence so tempting would ever be forgotten if it were once known. But in most countries where grains and fruits were cultivated the process of fermentation must sooner or later be discovered at first accidently by observing the changes in suitable juices and mixtures allowed to stand. Thus, in Mexico the milky juice of aloes (Iraktapolam, chennanayagam) is fermented into their beer 'pulgue'. In Asiatic countries and Africa the date and other varieties of palms are tapped for making toddy or palm-wine In Portugal and the Goanese territories in the west coast of India the juice of the ripe cashew fruits (anacardiam occidentale) is largely used for the preparation of arrack. Cider is prepared from applejuice and mead from honey; koumiss of the Tartars is mare's milk allowed to ferment. The aboriginal races of Assam made a beverage by fermenting rice known as "pachwai," and by fermenting palmjuice, tari or toddy.

The first mention made in history is of beer prepared from barley and rye by the anceint Egyptians, which evidently spread later to European countries and Russia. In Africa millet was in common use and early Chinese used rice-beer, while the American Indians made their beer from maize or cassava. Wine seems to be much less ancient and the portraits of vineyards and presses may be seen in old Epyptian paintings and pottery. Yet wine-making as at present is still the same art as it was in the days of early history

There can be no question that the Ancients had known of the hilarious effects of intoxicating drinks and they regarded them as "a means of drowning cares and stimulating dullness into wild joy divinely bestowed upon man". They drank them solemnly in their religious feasts and offered to their gods also. Thus, we read of Indra, the Heaven-God of the Hidus, reeling drunk with the libations of the sacred soma-juice offered by his devotees, and in later periods of the Greeks singing in bacchanal processions the praises of Dionysos, who made the whole world happy by his "care-dispelling" juice of the grapes.

The juice of the Soma-plant was a favourite drink of the

early Aryan settlers of India many centuries before the Christian Era.

What exactly was the Somaplant is not known, though a number of plants such as Cannabis Indica, Ephedra Vulgaris, Asclepias acida have been suggested by Chopra.

But even at such early days there seems to have arisen an opposite doctrine, and the guardians of religion sensible to the evils of intoxicants proclaimed not only that excess in them was unworthy and hateful, but even the mere tasting of them was a sin. The Brahmins, although the libations of the sacred Soma still remains a tradition among the Hindu religious rites, pronounce drinking of liqour or habitual use of any intoxicants as one of the Five Great Sins (Pancha maha patakani). Even in the old rival religion of Buddhism one of the precepts or commandments that the new adept promises to obey is that forbidding the use of intoxicants of all sorts. The religion of Mahammad, though in a large measure the outcome of the religions of the Jews and Xians cast off the ancient sacredness of wine and forbade its use as an "abomination" (Haraam). Infact, there is no religion which permits the use of intoxicant drinks or drugs.

Nevertheless distilled spirits were known early in the East but came into use among the Western Nations about the Middle Ages and spread rapidly among them being considered the "water of life" (or aqua vitae, as the modern word "whisky" indicates) so much so their employment as a habitual stimulant is to day perhaps the greatest evil prevailing among the civilised nations of the world, bringing about in the lower strata of the population a state of physical and moral degradation hardly parallelled in the worst ages of History.

If we should examine the question, what were the initial stages in the introduction of alcoholic appetite into modern society the answer is not far to seek. Highly speiced meat-dishes of civilised cookery tend to produce an abnormal thirst which requires something stronger than water to quench; irritating condiments are as a rule, injurious to the digestive organs and are also obnoxious as creators of the liqour-thirst. There is, therefore, no doubt that the free use of condiments used with

meat intensifies the stimulant effect of the extractives contained in the meat, which latter are themselves, apart from their accompaniments, stimulating to a good extent.

Viewing the subject broadly it is well known that nations consuming large quantities of meat as food are, as a rule, also noted for an excessive consumption of alcoholic liqours, as the craving for alcohol can be overcome only with the greatest difficulty when a flesh-diet is adopted; whereas this craving loses its hold on the victim when a diet of cereals, nuts, fruits and vegetables is adopted.

India has been the home of temperance from time immemorial as her principal religions and codes of Ethics, we said, all taught temperance not only in the matter of alcohol but of all kinds of intoxicants. But today we see drink has become the commonest evil of our Country and exists not so much among the unlettered villagers (among whom liqour taking is a social stigma) as among the industrial workers and the so called educated societies in towns and cities. The labourers took it in the absence of a recreation after the hard day's toil, whereas among the educated and well to do classes it was regarded as an instrument of "good fellowship".

We have already pointed out how the good fellowship in the beginning leads to bad citizenship in the end; and the formal "good luck and good health" wished each other at socials generally ends in ill luck and ill-health. To such a deadly evil the golden advice applies, "Touch not, taste not, handle not. Truly wine is a mocker, strong drink is raging and whosoever is deceived thereby is not wise." Medical opinion has never been more unanimous in respect of the drink-evil.

The only way to get rid of this enemy is to cut the drink squarely off and to adopt a simple non-meat diet consisting of cereals, nuts, fruits, vegetables, milk etc. . It is said that the free use of fruits brings the system back to a new condition of health in which the old appetite can be entirely cast off. Moral strength is, however, required for this purpose and nothing brings it like Prayer and submission to the Divine Will, as He alone can come to the rescue of the fallen victim and no human being can.

Intensive propaganda and advice on temperance and making the teaching of Hygiene and Temperance compulsary in public schools have been tried but have been of little avail in eradicating the evil or even abating it; and public opinion throughout the civilised world now seems to favour the view that some sort of State-interference is necessary, and though the facts discussed above may not be the entire grounds on which the wisdom of "prohibition" by legislation could be based, they nevertheless form an important evidence in its favour. Anti-prohibitionists question the propriety of any legislation in this regard, as, they say, it interferes primarily with the personal liberties of man, as alcohol, they argue, immensely contributes towards "life's pleasures and conviviality.' Such pleasures we have seen, are, however, momentary and are bought at very great cost indeed and at the risk of the welfare of the entire nation.

Now that our Country is definitely committed to a policy of prohibition the question arises how best to achieve this end. The experiment of total prohibition had been tried in America and some of the European States and attempts made to enforce it by means of special preventive services at immense cost; but after about 12 years' time the experiment proved an utter failure, with the result that the State not only lost the huge revenues and excise but had to spend large sums of money on the preventive measures in addition, and the consumption of alcohol remained little changed.

The reason adduced is that in America this problem was considered purely from a moral and religious point of view and not from the point of its being a social and economic evil, as it is everywhere. Further, it is said that the protagonists themselves forming the wealthier class were not sincere in their pursuit as they still continued the use of liqour being little affected economically thereby.

The system of limiting the number of hours of the sale of spirits in public places has been tried in Europe, but has not met with any appreciable success.

The Indian problem, however, appears to be less intricated

the drink-evil being much less prevalent than in America or Europe, and all that is required to be done is to keep the temptation of drink out of the way of the poor labourers, peasants and the lower classes of population, because it is they that are most affected by the evil habit and not the other classes who do not as a rule take alcohol, and if they do, they are not much affected economically thereby.

The lessons learnt from the history of prohibition in Europe and America do, therefore, teach that the Indian problem has to be considered only from social and economic standpoints, and not from a religious one, because, however important the moral and religious aspects be, they cannot be enforced by law, but have to be left to individual enlightenment; and the social and economic welfare can, however, be achieved by enacting law. Such laws have already been formed in our Country by the present Congress Government and experiments already set on foot in some of the Districts of Southern India and elsewhere, and so far there are good indications of the experiments proving successful.

Toddy

Toddy is obtained by tapping palm or date trees and is the chief form of industry in a number of provinces of India. The juice when fresh is absolutely non-intoxicating and forms a pleasant and nutritious drink. But when the juice is allowed to ferment,—which it does ordinarily within a few hours of exposure—then only it acquires mild alcoholic properties.

Now, it is quite easy to collect the toddy in an unfermented state; but what the usual practice is, the same pots are being used over and over again without cleaning between the collections; this facilitates fermentation. But if the pots are washed clean every time and smeared on the inside with slaked lime the juice obtained can be prevented from fermenting for some hours. Addition of a small quantity of solution of Sodium Benzoate or any acid like Boric acid or some other antiseptic preserves the palm-juice from fermentation. The palm-juice before fermentation is used for the manufacture of jaggery, a form of crude

sugar cheaper and, as we shall see later, far richer in nutritive value than and superior as an article of diet to refined sugar.

Unfermented palmyra-juice has actually been a valuable agent in helping prohibition, as it provides a healthy pleasant drink in place of fermented toddy to those who are accustomed to the latter, thus enabling to satisfy their craving and gradually give up the drink-habit.

The alcoholic content of the majority of the country-beers used in India like Toddy, pachwai, and zu (a drink used by the Nagas of the Assam Hills) is low (not exceeding 10 p. c. of Absolute alcohol), but their nutritive and vitaminous value is very high, so much so it has been proved beyond doubt that the parts of India where such drinks are in common use are remarkably free from Deficiency Diseases. We shall see later that yeast or toddy is usually adopted in the treatment of Beri-beri and cirrhosis of the Liver·

Distilled country-liqours and foreign liqours are used only by the richer classes but to a lesser extent. Their alcoholic percentage is rather high. Thus:

Rum, Whisky and Brandy and gin.	contain	40 to 45 p. c.	alcohol
Port, Sherry, Madeira	,,	18 to 22 p. c.	,,
Burgundy, Champagne, Claret	,,	10 to 14 p. c.	,,
Beer, Stout, Porter	,,	5 to 7 p. c.	,,
Wines (variable)	,,	5 to 20 p. c.	,,

10. Tobacco Habit

This weed is originally a native of America but is at present grown extensively in India and elsewhere. The name Tobacco seems to have been derived from the inhaling apparatus of the Caribbes, called "tobaco". Tobacco had been in use among the Aborigenes and was introduced into Europe soon after the discovery of the New Continent by Columbus at the beginning of the 16th Century; but there are ample proofs to show that the Chinese had known about tobacco and its properties even about the 13th Century, that is, long before Columbus or his America.

Sir John Hawkins it is that is said to have introduced

tobacco for the first time into England from Florida, but some say it is the great Sir Walter Raleigh. Whether it is Hawkins or Raleigh neither of them deserves any credit in this respect as the use of the drug soon spread to the Continent and the East until today the whole of the civilised world has fallen a victim to its habit. Jane Nicot, a Portuguese, introduced it into France, and from him is derived the name, nicotine, the chief alkaloid contained in tobacco.

The smoking habit was considered dangerous and was once violently opposed by those in power, notably James I of England, The Czar of all the Russias, The Shah of Persia and Pope Urban VIII; the latter pronounced tobacco an "accursed" thing like liqour; and inspite of severe punishments like scourging(whipping) cutting off the nose etc., or even death-penalty meted out to the most obstinate smokers the evil grew apace. In England even the "thundering invectives" of James I were nothing in the face of the craze for smoking, and in one of his pronouncements he denounces the habit in these words: "It is a custom loathsome to the eyes, hateful to the nose, harmful to the brain, dangerous to the lungs and in the black stinking fumes thereof nearest resembling the horrible Stygian Smoke of the pit that is bottomless."

With all this opposition we nevertheless see that smoking has so much advanced in public favour that it has today practically the whole world at its feet. How is this accounted for? Because tobacco is a powerful narcotic having its influence on the nervous system and is an extremely deceptive drug creating in the smoker a sense of temporary felicity, a feeling of ease and wellbeing that has no real existence. It often seems to allay nervousness when in reality it slowly and unawares breaks down the nervous system and leaves the victim a nervous wreck "as smoke clouds the intellect." Hence the popular belief "He who smokes not may fume."

Sometimes tobacco seems to exert a stimulating effect on the brain, but this is invariably followed by a period of depression, so much so a craving is soon induced leading to a repetition of the dose with perhaps an increase in the amount also,

In this respect it closely resembles alcohol. The peculiar fascination of tobacco making it difficult for the victim to give up the habit should be considered a powerful argument in itself against the use of this dangerous drug.

The chief chemical constituents of tobacco smoke are: (1) Nicotine, the active principle. It is an oily substance and is highly poisonous. It is said that a drop of it placed on the tongue of a snake immediately kills it. (2) Prussic or Hydrocyanic acid (oil of bitter almonds) This is admittedly another deadly poison; and (3) Carbonic acid and traces of sulphuretted hydrogen, and yet the drug is named "the fragrant weed."

Tobacco is universally considered dangerous especially to the young as it enfeebles the mind, weakens memory, weakens the heart and lungs; infact, it dwarfs their half-developed organs and in various ways interferes with their normal development. Surely parents and teachers are not awake to the fearful ravages of the cigarette habit amongst their children, else they would put forth greater efforts to warn the little ones against this vice. Dr. Clinton of San Francisco, physician to several Boys' Schools writes:

"A good deal has been said about the evils of cigarette-smoking, but not one-half the truth has ever been told. Cigarette smoking first blunts the whole moral nature. It has an apalling effect upon the physical system as well. It first stimulates and then stupefies the nerves. It sends boys into consumption. It gives them enlargement of the Heart and sends them to the insane asylum. I am often called in to prescribe for boys for palpitation of the heart and in nine cases out of ten this is caused by the cigarette habit. I have seen bright boys turned into dunces and straight forward honest boys made into miserable cowards by cigarette smoking."

But the evil effects of tobacco are not confined to children alone. They are equally injurious to adults too as is strongly maintained by medical men who have given this matter their special consideration. Excessive smoking gives rise to chronic Pharyngitis with irritability of the throat and cough and might ultimately predispose to Tuberculosis. The blood becomes impoverished and circulation affected; palpitation of the heart

and pain over the heart region, being the chief results. Sometimes, though rarely the cardiac pain may be so intense as to simulate angina pectoris. Tobacco-heart (also called Irritable heart or Soldier's heart) is a dangerous affection rendering the victim unfit for active field work and has led to the rejection of thousands of would-be recruits to the late wars; and Colleges and Universities have recognised that cigarette smoking has seriously interfered with the efficiency of their athletic teams, and whoever desires to be in the best form should abstain from smoking. Confirmed smokers have never been amongst long-distance-swimmers or rowers or cyclists. Dr. Seawer, Professor of Physical Culture in the Yale University found by a series of experiments that non-smoking students made far better records in physical development than smokers, their increase in height was 24 p. c. more than the others, while in their chest or breathing capacity, their superiority was more than 77 p. c. (Olsen).

Smoking is a common cause of dyspepsia; such cases do yield to no treatment unless and until the habit is discarded.

Confirmed smokers do suffer from some sort of weakness of eyesight (amblyopia) and sometimes actual blindness (amaurosis); and investigations have confirmed the observation that men employed in tobacco factories do also suffer from such defects.

Other organs like the liver and kidneys also are not spared by tobacco; and perhaps its most pernicious action is in causing a general lowering of man's vitality and his power of resistance to disease. As in the case of alcohol a confirmed addict has very poor chances of recovery from any disease that he might contract. Surgeons dred to operate on such a person as he is a difficult subject for chloroforming by reason of weakness of the heart and lowered vitality, and the operation wound will heal but slowly if at all.

Smoking produces in the long run a form of chronic inflammation especially of the tongue, (the glossy tongue) giving rise to whitish patches (leukoplakia), which in the aged or in the debilitated easily become cancerous; and cancer is extremely common among people who smoke the pipe. Cancer of the mouth is equally common among those who constantly chew

tobacco with betel leaves and chunam. The calcium contained in the chunam and the clay pipe seems to increase the irritation and especially favours the onset of the disease. Thus, most of the cases of cancer of the mouth in South India are traceable to the habit of chewing tobacco with betel leaves and chunam.

Tobacco is, no doubt, an oral disinfectant and deodarant and physicians and medical students often resort to smoking while attending a case of infectious disease like cholera or conducting an autopsy on a decomposed body.

The notion that smoking aids in mental work is erroneous. Tests in Universities and public schools have been made in this respect and have conclusively shown that non-smokers possess higher avereges of intelligence and scholarship.

After many bad reports a good one can at last be given about tobacco. New investigations have demonstrated that nicotine has a beneficial influence on the suprarenals and encourages a large secretion of suprarenin or adrenaline. Thus, the glycogen in the liver and kidneys is converted into glucose and the sugar content of the blood is increased.

The same takes place after meals and this increased sugar content abolishes the sensations of fatigue and hunger. This explains the craving of tobacco when tiredness or hunger is experienced. And it is the experience of many that a light smoke in the company of friends especially after a heavy meal does away with most of its discomfort.

Although smoking by reason of its inherent fascination has achieved so much of popularity all the world over there is a good number of great men who never became enslaved to this evil. The greatest names in literature cannot be associated with "the fragrant weed," and Homer, Virgil, Dante, Chaucer and Shakespeare—all wrote their beautiful thoughts in beautiful words "unclouded by smoke." It is said of Sir Isac Newton that when he was urged to smoke he nobly replied "I would make no necessities for myself." Gladstone and Salisbury were non-smokers and possibly on this account they both lived to a ripe old age and possessed active minds and considerable vigour of body almost to the end.

Amongst the more modern men of prominence such as Lord Roberts, Lord Balfour and Marquis of Landsdowne in England, Roosevelt and his illustrious predecessors in America are all non-smokers. Benjamin Franklin was another American who never smoked. The two "Ironmen" of the present age, Mussolini and Hitler, both of superb physique and both carrying enormous loads these days have never smoked. They are, moreover, exclusively vegetarians, never touched alcohol and never drank tea or coffee; their vitality is amazing and their energy unbounded.

The great General Grant was an inveterate smoker and died of cancer of cheek; Emperor Frederick of Germany, father of the great Kaiser is said to have contracted through excessive smoking the throat affection which finally cut him off in the very prime of life.

On the other side of the picture may, however, be mentioned Carlyle and Ruskin, both literary giants; they were inveterate smokers and regretted their inability to shake off the enslaving habit.

History abounds in instances of great men who would have perhaps shone brighter had they not fallen an early prey to this vice, so much so it is said of them **"they were great not because of tobacco but in spite of it."**

Tobacco Chewing

This habit is common only in India and the East, and the dried leaf is generally chewed either alone or more commonly with betel leaves and arecanut with chunam. The presence of the alkali (of the chunam) seems to oxidise the nicotine and favours its absorption in the mouth itself. The effect of the absorption of nicotine on the system are practically the same as we have discussed already in whatever manner the drug is introduced into the system; even half ounce of a strong infusion of tobacco leaves injected into the rectum might produce alarming depression and even death.

The susceptibility to cancer of the mouth in tobacco-chewers has already been referred to and is the greatest draw-back.

Pyorrhoea is very common among chewers and is mainly due to want of proper care of the teeth in cleansing them.

Tobacco-Snuff

Usually prepared by drying the leaves over live-cinders until they became brittle and can be reduced to powder; next, this powder is ground down into finer powder with a small quantity of cow's ghee and dried slaked-lime. As noted above the addition of slaked-lime seems to oxidise the nicotine and accelerate its action. The nasal mucous membrane is especially prone to irritation by the constant use of snuff, and it is said, that the effect of tobacco on the eyes is sooner manifest when the drug is used in this manner.

To give up the tobacco habit: It is not a very difficult matter to give up the tobacco-habit. When the craving comes one or two lemon drops or slices of sweet fruits put in the mouth help to allay the craving. A strong will is of course of greater importance in stopping the habit.

11. Pan-supari (Betel and arecanut)

The Eastern habit of constantly chewing betel leaves with chunam, arecanut, catechu and tobacco undoubtedly predisposes to pyorrhoea alveolaris among adults and we have already seen how the constant irritation of the mucous membrane of the mouth and the tongue by the acrid tobacco predisposes to cancer also.

Fresh betelnut (arecanut) seems to have some poisonous principle causing faintness in the user especially with some idiosyncrasy.

Tartar on the teeth seems to be specially favored by its use.

Nevertheless, it must be said that a sparing use of betel leaves and nut but **without tobacco** after a full meal acts as a sialagogue(increases the flow of the saliva) and reflexly stimulates the flow of the gastric juice in the stomach. It thus helps digestion.

12. Drug Addiction

Even from the earliest days of history mankind appears to have been accustomed to attain degrees of emotional intensity

and duration by having recourse to certain narcotics such as alcohol, tobacco etc. not so much for their nutritional value (which in the case of habit-forming drugs is no consideration whatsoever) as for their stimulating and exhilerating effects; and the earliest records available show that Opium, Ganja (Indian hemp) and certain other narcotics like Hemlock (Hyoscyamus) have also long been in constant use among them. Latterly certain drugs like cocaine, chloral hydras and barbituric acid derivatives (like Veronal, medinal, amytal etc.) came to be added to this list.

Addiction to narcotics is seen all over the world and the first inducement to their use seems to be many and varied. Some take them merely out of curiosity to test their action, others with the object of enjoying their pleasurable effects on the brain; and prolonged use of certain drugs taken as medicine for relief of pain, mental and bodily, has also claimed its victims in some cases. Such patients overcome by the influences of these drugs have in some instances become confirmed addicts.

The drugs used vary in their action. Some are stimulating, others depressing, but each gives to its devotee a certain measure of comfort and pleasure tending slowly and in an inexplicable manner to create in him a craving for it and unconsciously giving rise to habit.

Habitual use of most of them, like opium, alcohol leads to grave moral and physical degradation as the habit once contracted cannot be easily got rid of. Addicts are recognised as persons who not requiring the continuance of the drug for relief of symptoms of illness have acquired as a result of repeated administrations an overpowering desire for its continuance. In them the withdrawal of the drug leads to definite symptoms of mental and physical depression or disorder.

The problem of drug addiction in India presents many features, which are widely different from those met with in the Western Countries and America, and as we have seen, the habitual use of drugs of a stimulating or restorative character was prevalent in our Country long before it did in any of the other countries of the modern world. The juice of the somaplant, we

said, was a favourite drink of the Early Aryan Settlers of India. During the Hindu Period till about the 9th Century alcoholic beverages were freely used by people as well as preparations of ganja or Indian hemp. They produced not only a sedative effect but also brought about "euphoria in the form of pleasant dreams, forgetfulness and voluptuous satisfaction."

Opium and poppy were originally introduced into the West Coast of India about the 9th century A. D. by the advent of Muslim traders of the West and opiates soon came into use. A study of the Records shows, that during the period of the Moghul Empire alcoholic beverages, opiates and hemp-drugs were freely used. A decoction of poppy capsules known as Koknai was extensively used all over India and is used to the present day in certain parts of the Punjab. A beverage containing wine, opium, Indian hemp and poppy capsules known as 'Charbhaga' (four-leaved) was drunk by the well-to-do classes in the time of the great Akbar and later. Opium on account of its strong intoxicating properties appears to have taken easy hold of the people and is indulged in by all classes, and it is said that poppy cultivation was extensively carried on all over the Country during that period.

A. Opium

Opium is the inspissated juice of the unripe poppy capsules (Papaver Somniferum) obtained by incision. Raw opium is generally consumed in the form of a pill or solution in water; smoking of opium is uncommon except in the lower strata of society. Opium smoking is more common in Assam, Central Provinces and Berar than in other parts of India. The proportion of opium smokers to opium-eaters in Assam has been variously estimated from $\frac{1}{3}$ to $\frac{1}{2}$ of the total addicts, but recent enquiries show that the number has now come down to $\frac{1}{4}$. At present the Govt. of India and all the Provincial Governments have adopted the policy of checking opium-smoking by diminishing the facilities for the practice of the habit by legislation. As a result of such measures opium smoking has greatly declined; and although opium-eating is habitually done by large sections of the population

the indulgence is not at the present time so widely prevalent as it was some years ago. The Govt. of India have strictly adhered to their promise to the League of Nations and have progressively reduced both the production and consumption of opium, so much so within a space of 20 years the total consumption of opium in British India (excluding the Indian States) has come down from 500,000 seers to 200,000 seers (one seer is approximately 2 lbs. The average dose taken was roughly 10 grs. per addict (Chopra) as compared with 20 grs worked out by the Opium Commission of 1895.

The problem of addiction to opiates in India, although still extensive, does not appear to exist in such intense and pernicious form as it does in the West with Morphia and other alkaloids of opium.

In olden days when opium was cheap addicts were undoubtedly found who took 180 to 500 grs. of the drug daily, but now on account of the rise in the price smaller dosage, not more than about 15 grs. daily, is now adopted. It must be said here that the British Pharmacopial adult dose of opium is 1 to 2 grs., and opium is not prescribed for children under one year of age, and after that age only particular B. P. preparations are given and in very small doses and only in the presence of disease.

Habitual administration of opium to infants at certain periods of their life has been prevalent in India for many centuries. The habit appears to have been started from the knowledge that opium allays pain, cough and diarrhoea and promotes sleep. In some of the Industrial Towns of India and in C. P. and Berar it is said that about 75 p. c. of infants of mothers working in factories are doped with opium, (balgoli or pills for children containing opium are employed in Bombay) to quiet them during their mothers' absence on work in the factories or cotton fields, and the practice starts during the first few weeks of infant's life and is continued when the child attains the age of 2 or three years when it need not depend upon the mother for its food. Such drugging affects the children's health and stunts them in body and mind, and they are more liable to catch infection, the mortality among them being comparatively high; but death by overdose is rare.

''Post'' or unlanced capsules of poppy are known to have been used for their soporific (sleep producing or quieting) properties in ancient Egypt and Turkey, and by the Greeks and Romans and the Chinese, and employed in medicine. Opium is still cultivated extensively in Smyrna and Constantinople. During the Mogul period beverages prepared from the poppy capsules were extensively used for their euphoric effects and are still in use in some parts of the Punjab and Rajaputana. Chopra concludes that the habitual use of poppy heads produces physical, mental and moral degeneration in the habitue in a more pronounced degree than in those using opium.

The chief narcotic principle of opium is the alkaloid morphine or (morphia) Habitual use of morphine has of late spread to India from the Western countries. The opium alkaloids (morphine, codeine, heroin etc.) were at first taken almost exclusively by the mouth but recently their injection has come into vogue. Habit of taking morphine by injection produces a state of chronic morphine-poisoning (morphinism) which ''detrimentally affects all tissues of the body particularly the nervous system''. In morphine habitues the physical, mental and moral degeneration do set in much more rapidly than in opium addicts. Addiction to other alkaloids of opium, viz., codeine and heroin, is rare in India,

Opium and its alkaloid, morphine are used to lessen pain and procure sleep in all conditions of pain and disturbing influences like cough, dyspnoea, and surpass all other drugs in this respect; but the relief of symptoms obtained from them is only temporary, and persistent use of the drug may do definite harm by masking the symptoms and obscuring the diagnosis of disease. The danger of habit-formation should also be borne in mind and it is in cases of neurotic individuals and in chronic disease that prolonged use of the drug leads to addiction.

Heroin, another alkaloid of opium similar to morphine, is such a dangerous drug of addiction that its use should be allowed only under doctor's advice.

Codeine is mostly used in diabetes and irritable cough. Addiction to codeine is very rare in India.

Opium poisoning. Opium is the commonest suicidal poison used in India as death thereby is least painful. In children poisoning is usually accidental, the drug being usually employed in the form of soothing syrups (containing opium) to produce sleep in infants and many a time, the sleep that is produced "knows no waking;" opium is sometimes administered with homicidal intent also in children. Fatal dose for adults is 4 grs. of opium. Habit produces tolerance for the drug. It is said that De Quincey used to swallow 9 oz. of laudanum daily. Laudanum is Tincture of opium containing about 32 grs. of pure opium in an ounce, so that $32 \times 9 = 288$ grs. of opium equivalent to about 30 grs. of morphine would be contained in 9 ounces. A more remarkable case of tolerance to morphine is mentioned where the individual is said to have been taking daily 40 grs. of morphia hypodermically or 80 grs. by the mouth; the usual medicinal dose of morhpia being $\frac{1}{4}$ to $\frac{1}{2}$ gr. hypodermically. In susceptible individuals even the smallest dose of morphia or opium produces alarming symptoms.

B. Indian Hemp

Synonym—Cannabis Indica, Cannabis Sativa—This hemp grows wild in the mountainous and sub-mountainous tracts over the whole of the North Eastern and North Western parts of India. The writer has personally observed large tracts of wild growth of this plant along the Railway lines between Hardwar and Hrishikesh. Its three preparations that are in common use are:

(1) Bhang—the dried leaves of the plant pressed into cakes.
(2) Charas—the resinous exudate.
(3) Ganja—the flowering tops
(4) Majum—a sweet prepared with one of the above preparations.

They are extensively employed by the poorer classes and Bairagis on account of their low cost, so much so Chopra estimates the incidence of addiction to this drug in British India ranges between O.4 to O.8 p. c. of the population. In Southern India where spontaneous growth of the plant does not occur it is still cultivated for use as a drug of addiction.

The physical effects produced by habitual use of hemp drugs are not so marked or deleterious as those of opium, but they undoubtedly lead to physical, mental and moral degeneration. While under the influence of hemp drugs the addicts appear to lose all power of orientation (idea of correlating time and space) and forget their environments and cannot understand what they are doing; and in certain cases the habit leads to insanity and crime. Ganja and charas are more potent in this respect than bhang. The drug is either smoked alone in chilm or with tobacco as beedies, or taken as a drink or panak on ceremonial occasions well rubbed down with milk, poppy seeds, cardamoms, sugarcandy and almonds or cashew-nut kernel. In whatever manner used the drug is decidedly harmful; and the popular belief "ಸುಟ್ಟವನು ಕೆಟ್ಟ, ಅರೆದವನು ಮೆರೆದಾ" (He who smokes ganja is ruined but he that rubs it into a drink will shine with radiant health) is quite unfounded and is only an excuse to start the ganja habit or keep to it.

Ganja may be used to facilitate committal of an offence like rape or robbery; for this purpose it is used as a drink or a sweet (majum), the latter for its aphrodisiac properties. Highway robbers often give it to their victims as a smoke mixed with Datura. Often times the drug (ganja) is mixed with potent drugs like opium, datura, Aconite and nux Vomica by those on whom the simple form of hemp drug has ceased to produce the desired effect of exhileration or stupefaction. When ganja is smoked or taken internally as a drink or sweet there is a stage of excitement followed by narcotism. They are more immediate in smoking. During the stage of excitement the individual is the subject of hallucinations usually of a pleasurable or sexual character. He may be constantly laughing, singing or furiously delirious. Small doses in susceptible individuals generally produce peculiar symptoms usually described as "floating in the air."

One curious effect of full intoxication with ganja is that it produces enormous apparent "prolongation of time and exaggeration of distance."

Hemp drugs are cerebral stimulants and they also produce

mental disorders; in the latter respect they are above alcohol opium or cocaine.

Medicolegal aspects. Insanity is the inevitable result of the use of hemp drugs whether in excess or in moderation for a prolonged period and is easily induced in those with a neuropathic or psychopathic heredity.

Persons intoxicated with the drug are often liable to commit homicidal violence or murders. It is said that many a time murderers may take the drug to steady their nerves before committing an intended murder.

"Running amok" is common in the intoxication from hemp drugs, the individuals committing a series of murders with or without a definite intent, the victims being not necessarily their enemies; after complete recovery they have no memory of their crimes and invariably plead "not guilty."

The ganja-habit among some cases of criminal lunatics appears to be rather a symptom than a cause of insanity—a vicious circle was thus formed, insanity leading to ganja habit and ganja habit leading to insanity or some form of "an acute confusion"—when the person does not know the nature of what he was doing.

C. Cocaine

Is an alkaloid, the active principle, derived from Erythroxylon coca and came into use quite accidentally about 80 years ago. In 1859 Scherzir brought the coca leaves from Peru Bolivia to Europe and noticed the numbness of the tongue and the mouth resulting from chewing the leaves. The Peruvian Incas Surgeons are supposed to have chewed coca leaves and dropped the Saliva on the wounds of patients. Coca leaves are chewed S. America as a restorative from fatigue.

Cocaine is not manufactured in India, but is largely smuggled by crews of ships running between Calcutta and the Far East and is heavily adulterated before being sold. Whereas in the West it is usually taken in the form of an injection or snuff, in India it is usually taken by the mouth with pan or betel leaf and is largely addicted to in the N. W. India, the Punjab, U. P.

and Bengal and Bihar. The habit is not only confined to the well-to-do classes but a large number of artisan-classes also in large towns. It has been calculated by competent authorities that 200,000 ounces of cocaine were smuggled into British India in 1929 and that the consumers paid between Rs. 270 lakhs and Rs. 648 lakhs to the retailers for their doses of the drug (Chopra).

Cocaine is habitually used as a mild intoxicant, stimulant and aphrodisiac (stimulating the sexual appetite) either by itself or with betel leaves and nut. Applied to the mucous membrane or a raw surface or injected under the skin it is a local anaesthetic deadening the sensory nerves. When swallowed cocaine produces stimulation of a pleasing or exhilerating nature followed by a state of mental depression In poisonous doses death is due to paralysis of the heart and respiration and is preceded by convulsions. About 1 gr. of cocaine is sufficient to kill an adult unless he is gradually habituated to it, in which case much larger doses are borne as in the case of opium. In chronic cocaine—eaters the most characteristic symptom is the feeling of the presence of sand or worms or insects (cocaine-bugs) under the skin (Magnan's symptom).

13. Infertile Marriage

Two quite opposite problems face the Medical Practitioner of the present day in regard to the function of reproduction in the woman. They are: (1) Birth-control, in cases in which for some reason or other pregnancy is undesirable and should be avoided, and (2) the relief of sterility in those desirous of getting children.

The birth-control problem has of late received so much attention of the public that the question, so very individual in its aspects, has now assumed the dimensions of a universal movement. Regarding "sterility" there is a universally sympathetic attitude towards the sterile woman whose desire for motherhood is so intense that she would be quite willing to submit to any measure directed to relieve her condition. No more pathetic is

the sight than that of a woman whose hopes of getting children have been continually frustrated month after month for years until perhaps she has reached the menopause, at which stage all hopes of conception have to be finally given up; and there is no patient whom the Medical Practitioner is more anxious to help than the woman, whose maternal craving to have a child makes her condition a miserable one.

There is no problem in the whole field of diseases of women (Gynecology) that baffles the Practitioner more than the problem of ascertaining the extact cause of sterility, as the condition is dependent upon several factors, such as tumours, congenital defects or obstruction of the Fallopian tubes, inflammation etc. But there are a number of cases where there are no demonstrable defects either in the wife or the husband. In such cases it is possible that the sterility is due to some defect in the physiological function of the reproductive organs, a function perhaps related to the endocrinology of the menstrual process. Although it must be admitted that our knowledge of this particular field is still in its infancy, certain physiological principles regarding menstruation have been of late scientifically demonstrated and established beyond doubt.

One principle, however, of practical benefit for all married women desirous of conception or even those who want to avoid conception is this: "Is there an optimum time for conception?" in other words, "Is there any phase of the menstrual cycle when coitus is more likely to be followed by conception than any other phase?" In the case of lower animals generally, except in the higher grade monkeys, coitus takes place only during the "rut" or "heat" period (Oestrus as it is known) and at the same time the ovum is discharged from the ovarian follicle, hence in them the time-mechanism for fertilisation of the ovum is perfect so that impregnation is the rule with coitus. But, in the case of human beings there is no particular time of oestrus and coitus may take place at various portions of the intermenstrual period and the time of ovulation is variable. The firtilisation in the human female is, thus, more "a hit and miss affair" than in the lower animals. This is in full agreement with the modern view regarding the

life span of both the ovum and the spermatazoon. The older view was that the ovum would live and be capable of fertilisation even as long as 2 weeks and the spermatozoa as long as 17 days after emission into the female organ. But, it is now established beyond doubt from observations made both on human beings and experiments on the higher grade monkeys that the period of survival of both the ovum and the sperm is not more than 36 or 48 hours and even less in the case of the ovum. In the light of this newer knowledge, it would seem that the possibility of fertilisation in the human female is restricted to that phase of the menstrual cycle roughly approximating the time of ovulation, that is to say from about the 8th to about the 18th or 20th day of the cycle. This in essential is the view point of observers like Knaus, Ogind and Hartman, and according to this view **"Coitus during the premenstrual and post-menstrual periods is characteristically sterile."** They have based their observations on clinical evidence obtained from studies made on the wives of the German soldiers on short furloughs during the Great War, and the studies of Hartman on monkeys have confirmed the truth of this view point—that there is an optimum period for conception.

Other observers on the other hand have denied the existence of a special optimum period for conception chiefly on the basis of the extreme variability as to the time of ovulation. Yet, when it comes to be a question of practical advice to a woman anxious to conceive we are justified in presuming that there is an optimum period of the menstrual cycle and that this period is from the 8th to 18th day after menses at which conception is most possible, especially so the period around the 12th to 14th day after menses. It will thus be seen that this knowledge will be equally helpful in avoiding conception, as coitus during the period outside the limits of "the optimum period for conception" is least likely to be fruitful. It may therefore be presumed that "if coitus takes place between the 8th and 18th day after menses the chances of conception are the greatest; and outside this limit coitus is not likely to be followed by conception,"

14. Contraception (Conception-Control).

Authoritative teaching on the subject of birth-control, or to be more accurate, conception-control is required for several reasons: In the first place such a control is necessary within certain limits; and secondly, the general public already know a good deal about conception-control and is anxious to know more. Instructions should be made available through medical men, as they are in a position to judge of the need for control on medical grounds and its advisability for economic reasons. Moreover, medical men can appreciate the conditions in which the control is harmful medically or inadvisable ethically. They are also in a position to give the best advice as to the most suitable method of prevention of conception to be adopted in individual cases. For want of proper teaching laymen have to go for popular treatises some of which written in erotic vein, with insufficient knowledge or with a marked bias and are therefore likely to cause a good deal of harm. They advise the use of appliances without selection of suitable cases or without discrimination as to the means to be employed. In these two pictures of the medical and popular expositions of the subject we have an epitome of the use and abuse of the teaching about contraception.

Medical grounds for Contraception. We said "birth-control" is not an accurate term to be used, because strictly speaking it includes "prevention of birth at full term by induction of abortion or induction of premature labour; the term "contraception" therefore, suits here better as our object is to prevent conception itself.

(1) Heritable diseases in either parent, such as Syphilis, Tuberculosis and Insanity. Syphilis is curable and once cured it ceases to be heritable; but as long as there are active signs of the disease in either parent begetting of children should certainly be controlled. In the case of Tuberculosis, they say, it is the tendency for the disease that is inherited rather than the disease itself. Regarding mental diseases it is a question of degree. Obviously lunatics and imbeciles should not be allowed to have children, but the minor forms of mental instability are often so

closely allied to genius that if such people were prevented from having children the loss to the State might outweigh the gain.

(2) Diseases making pregnancy and delivery dangerous to the mother, such as Heart disease, Tuberculosis, nephritis. Each case has to be considered on its own merits, but it is the rule in medical practice that the mother's safety should have preference over that of the unborn child, and *a fortiori* over the unbegotten child. In some of these cases the restriction needs only be temporary until the disease clears up.

(3) Conditions that would obstruct labour, such as contracted pelvis, Tumours, Congenital defects or obstructions and other abnormalities. If the obstruction is removable as in the case of tumours it is right to prevent conception until this has been done; but if it be permanent as in the case of contracted pelvis the patient has a right to choose whether she will take the chance of pregnancy with a view to delivery by Caesarian section about full term, or whether she will be exempted from pregnancy by the adoption of preventive methods.

(4) Previous difficult or dangerous deliveries. When a woman has passed through a difficult or dangerous confinement she has a right to say that she will not face the ordeal again even though the complications may have been of a type unlikely to recur. Some women with an ardent desire for another baby might be willing to take the risk; with others the prospect of another such experience would entail intense mental suffering and might easily cause a mental breakdown.

(5) Child-bearing in excess of a woman's strength. In many women a succession of deliveries has left them physical wrecks. It is quite essential for medical men to advise preventive methods in these cases in order that pregnancies may both be "spaced out" and reduced in number; if a woman asks for medical man's advice in such matters certainly she is entitled for it.

Economic grounds for Contraception. When we come to consider the economic grounds for contraception, ethical and sociological considerations overshadow the medical; and we find widely divergent positions taken up by thoughtful and

conscientious persons. The ardent followers of Malthus adduce many reasons why the population should be held in check; their concentration on abstract generalities places their vision out of focus for attention to the individual human side of the matter, which is atleast as important. At the other extreme some religious bodies such as the Roman Catholic Church denounce birth control in principle and can see no exceptions where it is desirable; save that they will rather unwillingly concede that there may be something to be said on medical grounds. "My position is intermediate" says Giles "I recognise that birth-control is a contravention of natural law, and that such contravention can seldom be carried out with impunity. But facts must be faced, and there are cases where the penalty of compliance with natural law is greater than that of defiance of it. But if my position is intermediate I must frankly confess that it is much nearer to the extreme of prohibition than that of wide adoption."

The plea that a couple cannot afford to have more children is one that is admitted as a permissible reason for birth-control. This presumes that they have one more already. Moreover, the poor drudge of a working-woman whose babies keep on coming so that child-bearing and ceaseless toil make up her entire existence deserves pity and help, and the resources of medicine should be applied to the limitation of her family. Of course, it is not right for people to begin married life by practising contraception; if they cannot afford to have one child they cannot afford to get married; and if the reason given is that they want to enjoy themselves and have a good time without the responsibilities of parent-hood, a fitting reply would be that the reason is an unworthy one; let such people enjoy themselves and have a good time and wait to get married until they have acquired enough unselfishness and seriousness of character to accept the normal responsibilities of married life.

Methods of contraception. (1) Abstinence. As a temporary measure this is reasonable, but for adoption during a considerable period it is not practicable. It asks too much of human

nature and opens the door to irregular practices and un happiness.

(2) Restriction of sexual intercourse to the "safe period." There is no period that is absolutely safe, but, as we have seen, it is generally agreed that the likelihood of conception is least in the latter part of the intermenstrual period, that is after about the 20th-day of the menses. This is the best method to be adopted where contraception is desirable but not an absolute necessity. It is the least objectionable method also.

(3) Prevention entry of spermatozoa into the vagina.

(a) One method is by "coitus interruptus," in which the male organ is withdrawn before emission. Generally speaking, this is unfair on the woman, as it is apt to leave her with "desire excited but not satisfied". It is not to be recommended.

(b) The other method is the use of condom or French—letter. When birth control is essential, but for a time only, and the possibility of conception at a later date should not be interfered with, the condom plan is the best. It has been maintained that it is essential for the seminal fluid to come in contact with the vagina in order that the woman may reap the full benefit of the sexual act; but says Dr. Giles, "This is not proved' and I hold it to be doubtful.'

(4) Mechanical prevention of entry of spermatozoa into the uterus. For this purpose various pessaries have been devised which are supposed to be introduced by the woman. They are all uncertain in action and their chief virtue is that they are a source of income to those who sell them.

(5) Chemical methods of prevention of entry of spermatozoa.

(a) The chief of these is the Quinine pessary, whose contents when the pessary melts kill the spermatozoa. This is one of the most dependable methods, and is free from the objectionable features common to some other plans. It is to be recommended when contraception is to be permanent. Often the chemicals are used in extraordinary strength and are therefore likely to produce inflammatory condition of the vagina and the cervix.

Most of the chemicals used as pessaries have the effect of

destroying the sperms, but their effect is, however, minimised by the material of the pessary—which may be cacao butter or gelatine in most cases. The effect is, therefore, not complete destruction of the sperms but "devitalisation" of the sperms themselves. The danger is, if such devitalised sperms do succeed in fertilising the ovum "a defective foetus" is the product, that means a defective individual, defective both in body and mind. This is, therefore, one of the risks of such contraceptives. The cacao butter itself may prevent the entry of the sperms into the uterus by forming a greasy coating on the cervix. Certain chemical pessaries do act by yielding a lot of froth on being dissolved in the vaginal secretions. "Speton" is one of such class. The froth seems to weaken the sperms, but not actually kill them, and if the weakened sperms should perchance succeed in fertilising ovum, a weakened offspring is the result.

(b) Douching the Vagina after coitus. This is a method whose action is partly chemical and partly mechanical. It is fairly safe, but not absolutely so; and it is a draw-back, not unattended by risk, for the woman to have to get up out of a warm bed in order to use a douche.

(6) Surgical methods. The vasa deferentia in the male and the Fallopian tubes in the female are cut and the cut ends are tied together. Cases of performance of this operation in man are very rare; and in the woman it is hardly justifiable to perform the operation for this purpose alone. But when an operation is necessary for some other reason it is a proper and legitimate procedure to divide the Fallopian tubes at the same time.

Drawbacks to Contraception. There are drawbacks to contraception both on public and personal grounds. A detailed examination of the public grounds would carry us too far with the Malthusian doctrines and one point only will be dwelt upon, viz., the disadvantages to a country that result from a falling birth-rate. It is said, on the other side, that there is neither work nor food enough for all and that the proper remedy is to limit the number of future wage-earners and food consumers.

"My own view is" says Giles, "that the fault is due to the conditions of work and not the numbers, and that altered

conditions would provide work enough for all the unemployed in the country. If birth control could ensure the elimination only of the unfit, the wasters and the degenerates, something might be said for it. But on the contrary, those who are least likely to breed valuable citizens are also the least likely to take steps in the matter. Restriction is more practised by thoughtful and efficient parents, whose offspring might well be of the greatest service to the community." Continues Dr. Giles "Then there is the personal side, and here I am not concerned with cases of restrictive methods adopted after several children have been born. But I am deeply concerned with restrictions adopted at the beginning of married life. The immediate effect is to foster selfishness and self-indulgence in the married couple and to rob the early married life of its proper romance".

Later Results of Contraception. (1) There are many instances of people who have avoided conception in the early years of married life and later on when they have changed their mind and thought that they would like to have children they have not been able to do so. This is possibly due to some change in the endocrine activities due to distortion of the normal sex-act. In some cases it may be due to the method of contraception employed such as the use of the Quinine pessary. However it may be there is no doubt about the unhappiness and the disappointment, the regrets and the mutual recrinations and sometimes even the permanent estrangement and separation that the later years of married life may unfold.

(2) Another late result is the physical one. Repeated sex-stimulus in early married life without the physiological rest and outlet provided by pregnancy predisposes to hyperplasia, chronic congestion and the development of uterine fibroids.

Summary. The least harmful plan is undoubtedly the restriction of intercourse to the socalled "safe" period; of the mechanical means the condom is probably the least objectionable. **Coitus Interruptus** has a bad effect on the woman's health in many cases. We have mentioned of the possible effect of Quinine pessaries in leading to permanent sterility. Some of the so called "check" pessaries may set up an ascending metritis

(inflammation of the uterine muscle) and salpingitis (inflammation of the Fallopian tubes)when used by careless and ignorant women.

According to Marie Stopes "where both the couple are normal and healthy there is no "safe" period; and where there is its use involves the coercion of a physiologically unready woman at times and the refusal of her at other times when she is ready for coitus, both of which are barbarous and immoral."

Contraception as a common cause of Disease. Certain contraceptives are injurious in themselves, e. g. the wish-bone pessary. The wish-bone pessary is a hollow bone button about 1″ long with either end slightly larger than the middle part. It is inserted into the os until the inside end is just past the internal os, the outer end then comes into just contact with the external os. It is claimed that the pessary can be left inside the os for a long time without bad results. Being hollow the menstrual flow is not obstructed thereby but the spermatozoa are prevented from reaching the uterus. The wish-bone pessary has even been found imbedded in a placenta and there is clinical and experimental evidence to prove that continued contraception hinders and may ultimately destroy the power of ovulation (Egg-producing power of the ovaries) and egg-bearing power of the womb (fertilisation of the ovum or conception). Now, coitus which completely satisfies the male does not however satisfy the female, her sexual pleasure only commences with coitus and requires the complete cycle of pregnancy, of birth and lactation to satisfy her natural appetites. To deprive her, therefore, of regular pregnancies is to do her the gravest wrong. Mc.Cann attributes certain commonest failings of the female sex to sex characteristics the chief of which is a natural inability to either see or tell the truth. Fibroids, cancer of the cervix or the body of the uterus and ovarian tumours may result from the use of contraceptives so much so the question is raised whether the routine or continuous use of contraceptives may not lead in time to the birth of a generation of women congenitally incapable of reproduction.

Chief References: Dr. Giles—Lancet 1927; Dr. Mc.Cann—Address at the Paris Conference (1928); Dr. Mary Stopes—Contraception.

15. Mental Hygiene

This is the science and art of directing one's actions, thoughts and feelings in such a manner as to enable the person to attain the highest possible level of efficiency, health and happiness. Intelligent adaptation to one's environment is the basic principle on which mental hygiene is founded; that is, the individual must accept the environment in which he is placed with determination to adapt himself to conditions as he finds them. There are two approaches to the attainment of mental stability; the most constructive of these two relates to the training of children in order that proper habits of action, thought and feeling may be inculcated in them during their period of growth and development. The second approach is to teach adults—Re-education of adults—such principles of mental hygiene as will enable them to make a more satisfactory adjustment than they have heretofore been able to accomplish.

Now, most cases of mental affections that consult the physician are of the nature of functional derangements or "neuroses," characterised by mental depression. Such people are advised to follow an individually planned programme of activity which keeps them busy major part of the day, provides sufficient exercise, a period of rest in the middle of the day, enough sleep at night, and some recreation. Often this treatment can be carried on in one's own home, but if circumstances necessitate a change to another environment it is important to see that the individual is provided with some form of occupational work to keep him engaged.

Neurotic individuals are frequently relieved by the opportunity of relating their history and difficulties to the sympathetic physician or sympathetic friends or relations, and are often amenable to treatment by "suggestion"—such as assuring them that they are organically well and that their difficulties are only functional in type.

The factors concerned with the production of neurosis are mainly:

(1) **Mental Fatigue**—Physical fatigue or hard physical

work seldom, if ever causes nervous disorders, in fact it often acts as an antidote and prevents the occurrence of such disturbances. It is the emotional wear and tear which accompanies the individual's occupation that leads to a sense of fatigue and leads him to the belief that his illness is due to overwork. Such a person should understand that work in itself is never a cause of illness, though perhaps one's mental attitude towards his work may be an important contributing factor in his difficulties.

(2) **Infectious Diseases**, such as even a common Cold, frequently give rise to temporary mental emotions, which are apt to occur during the period of convalescence. Colds are frequently followed by periods of increased sensitiveness and emotional depression. They are, however, temporary and are practically normal after—effects of the infections and disappear readily by proper care.

(3) **Loss of Weight** is another factor which causes mental depression. Practically 80 p. c. of depressed patients are under-weight, and in many instances the under-weight may be traced to some cause existing previously to the onset of mental illness. People should understand that they cannot lose weight with impunity, and in case they discover no cause for the loss of weight they should consult a doctor in order that both their physical and mental wellbeing may be protected.

(4) **Periods of Physiological Changes**, such as puberty, menstruation, pregnancy, and involutional periods, such as delivery and menopause, are frequently accompanied by emotional disturbances. At the time of puberty children pass through a period which is marked by great sensitiveness. They have a tendency to fix their attention on themselves and are often confused by the increased emotionalism, which is normal during this phase of their development. Majority of women are more sensitive during menstrual periods and usually experience a few days of depression at that time. Often pregnancy also gives rise to hyper-emotional state. Such disturbances are usually of short duration, and both husbands and wives should understand their significance.

The involution-period is nearly always accompanied by

mental depression, which frequently lasts for several months and which is often characterised by a tendency on the part of the persons to imagine that their condition is real. All these emotional conditions do usually disappear when the patient has passed through the particular period of physiological change. It is important that the individual so affected should understand that such disturbances are only normal, that they are transcient in nature and they will gradually pass off if they should be a little tolerant.

(5) **Physical Illness**—This is often conducive to emotional disturbances, which are due to the tendency of the patient to fix his attention upon himself and his ailment. Such emotional conditions are combated by explaining these facts to him and by using all available means, such as occupational therapy and other interest-stimulating activities to hasten recovery and to prevent fixation of his attention on his own difficulties. People should be taught to look on illness as a normal incident of life, which must be handled wisely from both the physical and mental stand points.

Habits. An important part of any mental-hygiene-programme consists of the training of the individual to employ wise habits of living, thinking and feeling, for these constitute an automatic protection against abnormal modes of life.

A budget of life-activities in terms of how each day will be spent is a necessity for modern man. Every individual should regulate his life so that he will have a proper proportion of work, rest, exercise and play every day. If one of these is left out it means interference in the harmony of life. As a result human beings who do not budget their lives wisely in terms of their daily activities are apt to discover that, sooner or later, they must pay the price of their carelessness in terms of ill-health. People who do not work are seldom happy, and are, practically without exception, greater "potential neurotic risks" than individuals who are employed. Occupation, preferably with a purpose, is one of the best known safeguards against mental instability.

Rest is likewise a necessity. The amount must be regulated

to the needs of the individual. As a rule one needs to rest 8 hours out of 24, and most people would profit by having say 9 hours. Similarly it has been found that where individuals are under considerable emotional strain in their work it is advantageous for them to have a rest of half to one hour in the day or in the evening.

Exercise, as we saw, not only promotes physical health but is also a means of dispelling emotional tension. The amount of exercise each individual needs must be adjusted to his physical condition and to the time at his disposal. The majority of our people need much more exercise than they take. This is particularly true of businessmen and housewives. A long walk 3 or 4 miles a day or some form of exercise equivalent thereto will be sufficient.

Play is an ever-ready method of relieving emotional tension and acquiring new interests. It has been well said that **children need to play, but that adults must play.** "Play is the shock-absorber which takes the bumps out of the road of life." In contradiction to work, which has been defined as "a responsible activity directed toward a more or less important objective" play has been defined as "an irresponsible activity directed toward a non-important objective." It is the element of irresponsibility which distinguishes play from work, a fact which is frequently forgotten by modern man, who is apt to take his play altogether too seriously.

Sports and Hobbies are conducive to mental stability, and for this reason, if for no other, should be carefully cultivated. The importance of interesting sports and hobbies is emphasized from the stand point of health.

Diet, as such, plays little part in mental hygiene. It seems that human beings who partake of a mixed diet in moderation are most apt to be physically and mentally comfortable. Contrary to popular opinion a moderate amount of coffee, tea, alcohol and tobacco is not injurious even to persons who are inclined to be nervous. Dietary fads are distinctly harmful and unhygienic and are scientifically incorrect; they often encourage patients to be more "suggestible" and are very apt to fix the

individual's attention on himself. It is important from the mental hygienic point of view that an individual's diet should not be interfered with unless actual medical necessity demands such an interference, temporary or permanent.

Constipation is not a **cause** of nervous or mental illness, but it is often the **result** of such difficulties. Nervous people are apt to worry about their evacuations, they usually rely unnecessarily on laxatives, and as a result of such reliance do not form habits which are conducive to normal action of the bowels. People should go to the closet at least twice daily, once in the morning on rising and again after breakfast or dinner and to remain there sufficiently long (10-15 minutes) unless an action of the bowels takes place before that time. They may, then, consider that they have done their part of duty and leave the rest to nature. People who have such an attitude seldom need a laxative.

Habits of thinking and habits of feeling are much more important from health point of view. People must learn to face realities whether they like them or not, and to consider each situation in terms of the principles involved rather than try to solve each situation as if it were a distinct and separate problem in no way related to the rest of their lives. Day-dreaming and phantasies are distinctly unhygienic and are apt to encourage hysterical reactions, as they are "a subversion of the proper use of constructive imagination." They are a type of self-indulgence which must be discouraged since they are conducive to mental ill health.

Instincts. Instinctive responses do exist in all human beings; while all have the same instincts they do not have them developed to the same extent. Hence we are apt to think of people as being basically apprehensive, or sexual or pugnacious (fighting) or egotistical. Such instincts will not probably change materially in the course of a life-time whatever be the training or environments. **Fear** is the strongest of all instincts and is the most difficult of human emotions to handle wisely: it is without doubt the greatest instinctive factor in causing maladjustment (improper adaptation to one's environments) and consequent

neuroses. People must understand that fear is a perfectly normal instinct, one of which they need in no way be ashamed, and which if employed as a stimulus to courage and adventure may be an important factor in their success and happiness. Basically apprehensive individuals must be taught that fear never injured any one, that it is a short lived emotion which will quickly pass off and must, therefore, be tolerated; fear has to be dealt with by first recognising it and comprehending its nature, and then reacting to the facts of the situation rather than to the emotion.

The sexual instinct is an exceedingly powerful urge in the lives of practically all human beings. In some, however, it is more strongly developed than in others and in such individuals it is therefore, more difficult to deal with. Psychiatrists believe that the sexual instinct is the basis of most maladjustments in the world and that all nervous disorders are directly traceable to the psychosexual life of the individual. It is, therefore, important that human beings acquire a rational attitude towards such sexual problems as masturbation, menstruation, sexual intercourse, pregnancy and the menopause.

Pugnacity or the instinct to fight is, when developed to a too great extent, a frequent cause of maladjustment. Over bearing, demanding, contentious and irritable people are difficult to live with, as they not only cause trouble for others with whom they are associated, but are in themselves decidedly uncomfortable as the result of their fighting tendencies. Pugnacity is a valuable quality if it be employed constructively rather than destructively.

Sensitiveness. Next to intelligence sensitiveness is the most valuable trait a person can possess, provided it is not badly directed, in which case it may be a most injurious tendency. A sensitive person possesses quicker and finer perception than does the less sensitive, and in virtue of this attribute he is capable of getting in closer touch with his environment; sensitiveness is thus an asset. Sensitive people dislike criticism and it is necessary for them to understand their dislike of criticism and to make up their minds that there is no way in which any human being can

avoid it. Criticism no one can escape and the sensitive person must largely learn to ignore it.

Environment plays an important part in both the causation and prevention of nervous and mental illness. Each individual enters the world with a certain amount of intellectual, emotional and temperamental equipment; this in turn is influenced by his life-experiences such as the amount and type of intellectual training which he recieves and the emotional influences to which he is subjected in the course of his development. The laws of heredity undoubtedly play a part in shaping an individual's destiny, but it has been well said that heredity ceases at the time of birth and from then on the environmental influences to which the individual is subjected are a most important factor in shaping his life and in determining his reactions to given situations. While it is true that human beings enter the world with inherent instinctive drives at the time of birth, there are relatively few specific stimuli which will arouse their emotional reactions. As time passes however, they acquire numerous stimuli which will automatically set off their instinctive forces. It is important to note that experience plays a great part in conditioning their emtional reactions.

"Conditioned emotional responses" are responsible for a major portion of certain objectionable traits of the human race. A child who had been punished while in school by the teacher who wore a black coat, for instance, might thereafter automatically be prejudiced against any one wearing a similar black coat. The baby who had been startled by the bark of a long haired grey dog was thereafter not only afraid of all dogs but also showed great fear of all fur garments as well as animals with long hair. A man who experienced an attack of fear while in a barber shop thereafter experienced fear in an inexplicable manner whenever he entered any barber shop. A woman whose only child had grey eyes felt automatically attracted to any child which had grey eyes.

The conditioned emotional reflex is responsible for many of the neuroses. This is particularly true of phobic (relating to fright) reactions. A person who experiences fear under a given

circumstance often attempts to evade similar conditions in the future in order that he may not run the risk of again experiencing the discomfort of fear; some people who have experienced discomfort in theatres and crowded places may find that whenever they are in a theatre or in a crowd they are automatically assailed by an acute form of fear which they are unable to account for. This leads to their avoiding theatres and crowds, often public places in general, and as they cut down first on one and then another of their normal activities they become definitely "phobic" and are unable to carry on their normal lives. If the conditioned emotional response were more generally understood with the recognition of the fact there is no need to avoid the situation which gave rise to them people would be less frightened by these reactions, they would be better able to handle them by virtue of their knowledge, and they would be less apt to acquire the phobic type of neurosis.

The "reconditioning" of the conditioned emotional response is fortunately possible. Such a reconditioning process is not only an important part of child-training but is useful in the treatment of many forms of neuroses in adults. It consists in introducing a pleasant factor in what has been an uncomfortable situation by the practice of acceptance and tolerance with a reasonable expectation that the undesirable and unwanted reaction will change to a more desirable and comfortable state. For example, the child who had been conditioned to fear by the stimulus of dogs or any type of fur was gradually reconditioned through a process of rewards and pleasures associated with animals and fur to where these objects no longer gave rise to this feeling within him, and similarly a man who had been frightened as a child while sailing in a boat and was thereafter afraid of both boats and bodies of water, was reconditioned by arousing his competitive tendencies: first by having him sail a boat in races until the fact of his being in a boat no longer aroused his fear automatically; and second, by teaching him to find pleasure in competitive diving until he no longer felt any fear in regard to water.

The training which a person receives in his youth plays a

very important part in mental hygiene; and many emotional reactions are acquired through contagion. Children who are associated with pugnacious parents are themselves apt to be pugnacious and children who are associated with apprehensive parents are similarly likely to be timid and easily alarmed. A careful and thoughtful analysis of the forces to which one was subjected in childhood is often very enlightening in helping an individual to understand the nature of his own reactions as well as to remove uncomfortable and objectionable traits.

Social factors. Our present day society is a closely-knit fabric and we must learn to fit into it, to play our part and contribute our share to the welfare of the group. Those who will not become a part of the environment in which they live, who hang back or for one reason or other refuse to fit into the world as it is constituted, as a rule become increasingly subjective and introverted and are given to neurotic and mental disturbances. It is no longer possible for individuals or nations to live alone in the world, for we are all interdependent on one another. We must therefore, learn to live and work together maintaining all that is good in our own individuality and yet employing our individualism for the welfare of the whole organisation. The adherence to such a principle is one of the basic laws of mental health. Social relationships should not only be maintained throughout life but should be constantly broadened in order that "the rough corners of our own personalities may be smoothened by the contact of broad associations" Through such associations we reach a better understanding of the world in which we live and by virtue of fitting into the social-whole we are better able to contribute to it.

Some people have a tendency to do their work and then isolate themselves as far as possible from their fellowmen. This is a great mistake. We must take every opportunity to mingle with our fellow beings not only on the basis of work, but we should also take part in their recreation and hobbies, and allow them to share these with us. Some few people allow their social duties to go to such an extent that it interferes with their rest and other occupations, which in turn is a mistake in the other direction.

Poverty and wealth are two other factors which are important to mental hygiene. If they are properly handled by the individual there is no reason why they should be a cause of nervous or mental difficulties. Poverty is often a drawback to good mental hygiene by limiting opportunities; such a limitation is, however, often more apparent than real, inasmuch as there are many opportunities for recreation, diversion and education of which people can avail themselves without expense and which are often neglected. Poverty also militates against mental health by virtue of the fact that people who are poor are kept so busy securing the essentials of life that they have little opportunity to cultivate intellectual and aesthetic interest.

It is necessary for people who have too little of the worlds' goods to understand that the material things of life are perhaps the least valuable of a man's possessions, and that poverty need in no way imperil a man's greatest wealth, namely his spirit, his courage.

Wealth and success are both often badly handled by the individual who possesses them. Wealth may lead to self indulgence, love of ease, a disinclination towards hardship and a tendency to fixation on self; while success may cause exaggerated feelings of self-importance, disregard of others, poor adjustments to one's environment, undue belief in one's own powers, and, if the individual has not further goals to work for a loss of interest, a feeling of futility and frequently depression.

People who have secured these two material possessions, wealth and success, should understand that they are often a handicap to happiness and nervous stability, and that therefore there is all the more reason for them to carefully abide by the rules of good mental hygiene.

Work and Business. Occupation is an important part of every human being's life; without occupation or work there is no happiness, little health and often nervous instability. The quicker a person can decide that he must work, that he is going to carry his full load of responsibility, and is going to do it gracefully and easily, the better is his chance for a comfortable, normal and succesful adaptation. One should work with a

purpose preferably a desire to be of service to humanity and with the minimum consideration of the personal rewards which will accrue from such effort. People must decide to do the job that falls to their lot intelligently, gracefully, interestedly and as well as their talents will permit.

Occupation brings one into intimate association with others who are employed along similar lines; and it becomes necessary to adjust to their ideas and to remember that life is eternally a compromise. If one's associates are people who respect their own intelligence, it will be necessary for the individual to modify his personal views in order to work with such associates.

Ambition. If ambition acts as an impetus to continued effort it is useful; but if it becomes a dominating drive which causes one to override others, to destroy the good which is in one's own nature as well as to ignore the opportunities for living a broad life, it is distinctly an injurious tendency. Hence it is a tenet of mental hygiene that 'human beings must socialise their ambitions.'

Frustration is a normal part of life and must be accepted as such. A period of failure is incidental to nearly every enterprize and one should understand that the feeling of failure (even though that sense continue for some time) is not in itself sufficient reason for abandoning an undertaking, but instead the job must be carried through to a succesful termination. If, however, this is impossible the individual must accept temporary frustration, profit by failure and courageously attempt another intelligent effort.

Sickness. All human beings have to experience a certain amount of ill health, some more perhaps than others. People must accept illnesses and treat them as a normal part of life and comprehend that they are not going to become invalids. Illness has a tendency to fix the individual's attention on himself; this tendency must be combated as far as possible by broadening the patient's interests and giving him every opportunity to indulge in any occupation which his illness will permit.

Adultery is a very frequent cause of mental disturbances also in addition to physical suffering. The experience is often

a blow to one's self-respect, which affects the mind seriously.

What is known as the **"Middle-age reaction"** is a state of mind which many people pass through between the ages of 45 and 55. It is usually marked by a fear that one is growing old, that one's usefulness is approaching the end, that the joys of life will not be as great in the future as they have been in the past and in general with a feeling of "What is the use of trying any more?" This is a period of depression and discouragement when life seems to lose its zest.

Individuals passing through a middle-age reaction should consider that they are not seeing things in their true value since their sense of proportions is distorted. They must be tolerant, do their job the best they can, broaden their interests and wait until this phase passes, secure in the knowledge that they will soon feel better than ever and have many happy years ahead of them.

Death is an event which most people fear. It is not only an adventure into the unknown but to most individuals it connotes the final agony and is, therefore, an event to be dreaded. This fear of death often arises in childhood and is a result of the way the event is treated by the adults with whom children were associated. Children should be taught not to look on death as a horrible ending to their lives but instead to view it as another adventure. In regard to a life after death people should feel that if there be a life hereafter, all that has gone before in their lives is merely a preparation for it, preparing them to meet their friends and loved ones and the great spirits of history who have gone before them. If there be no life hereafter, death can mean only sleep, and what can be more delightful than complete rest?

Likewise people must understand that death is not an agonising experience. The physicians of the world testify that death in itself is not unpleasant; even though in some few instances the patient seems to be suffering, the time quickly comes if one is in pain, when the higher sensibilities are so benumbed that one is no longer aware of pain or discomfort.

Suicide is a contingancy which most people consider at

some time in their lives, and the sooner a person can settle this matter for once and for all the better it is for him. It is impossible for any one to make a satisfactory adjustment to this world if he is always considering how he may escape from life if it becomes too difficult. "Escape" from life is always indicative of mental weakness, and suicide is in theory the best of all "escapes" which, however, no one can be sure, is an escape in fact.

Suicide is a cowardly act and an unkind act. It brings more suffering to other people than any thing else a person could do. It retards civilisation by setting a bad example and is a blow to the selfrespect and confidence of every other human being in the world with whom that person has been associated. It is, therefore, a cruel, cowardly, selfish and stupid performance. To attempt to commit suicide is criminal and the majority of people who commit suicide are mentally ill. Once and for all every human being should close this "door of escape."

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Mental Hygiene in general has opportunities for application in many fields such as Education, law, sociology etc. and is particularly of value in preventing many of the psychoses. It is also of tremendous value in the handling of the feeble-minded and promises much along the lines of prevention of mental stability and mental disease.

(Chief Reference: Personal Mental Hygiene.
William B. Terhune, M.D. Connecticut—Vol.12, Appleton.
The Practitioner's Library of Medicine and Surgery).

PART II

Dietetics

TABLE OF EQUIVALENTS

1 Gramme	=	*15.4 Grains*
1 Kilo-gramme or (1000 grammes)	=	*2 Pounds 3 ounces*
1 Ounce (weight)	=	*28.3 Grammes*
1 Ounce (fluid measure)	=	*28.4 Cubic centimetres*
1 Pint	=	*20 fluid ounces*
1 Tumblerful	=	*10 fluid ounces*
1 Teacupful	=	*4 fluid ounces*
1 Teaspoonful	=	*One fluid dram or $\frac{1}{8}$ of an ounce*
1 Dessertspoonful	=	*2 Teaspoonfuls*
1 Tablespoonful	=	*2 Dessertspoonfuls or ½ an ounce*

2 Pints make one Quart

8 Pints ,, ,, Gallon

PART TWO

DIETETICS

I. Food and Nutrition

The present knowledge of nutrition can be said to have opened one of the most dramatic chapters in the History of Medicine, and scientific facts about the relationship of food to growth, maintenance and repair of tissue on the one hand and to disease on the other have entirely replaced older theories, some of which are very vague or are of the type of "old wives' tales," and Nutrition has taken the centre of the stage.

Many of the clinical problems that daily face the physician have a direct relationship to nutrition: the recovery of patients from acute or chronic disease is dependent on the restoration of normal processes of digestion, assimilation and excretion; and the science of nutrition has much to offer in the way of securing such restoration promptly and effectively.

The physician has often to deal with another important class of individuals in his practice, such as those that consult him presenting signs and symptoms pointing to disturbance of the digestive or metabolic processes. In the same category come people who seek advice in controlling body-weight for physical or social reasons. Less frequently there may be individuals who look to the physician for advice in a personal nutritional programme as the means of health-building.

To meet the needs of all these adequately the physician must supersede the quack, the magazine column of advertisements and the Radio Broadcast as a source of nutritional guidance.

This end the physician can accomplish by becoming

interested in the technic of applying scientific knowledge to the nutritional needs of the normal individual, and the purpose of this chapter will be mainly to impart such knowledge even to the layman to help him in keeping "the doctor away."

A "Food" has been defined as anything which, when absorbed into the body via the alimentary tract (the food canal) is capable of enabling it (the body) to grow or to repair its waste, of furnishing it with material from which to produce heat, muscular work or other forms of energy and supplying certain substances known as "the regulators" of the body's functions of growth, repair and production of energy.

This definition of food is for all practical purposes comprehensive enough and brings into prominence the three main functions of food:

(1) The provision of materials required for growth and repair of the fabric of the body;

(2) supplying materials which can be oxidised in the body with the result that the energy set free by oxidation may be used in performing work and producing body-heat;

also (3) supplying the body with certain substances (Hormones, Enzymes and Vitamins) which serve to control the various processes of the body.

Now, very few articles of food found in Nature are simple chemical substances, most of them being a mixture of several different types of chemical substances called "nutritive constituents," and even the most elaborate product of the culinary art resolves itself on **Chemical analysis** into a mixture of these nutritive constituents. They are:

(1) Proteins—(a) Animal proteins, such as albumen (of the white of egg), casein (of milk), caseinogen (of cheese) myosin (of muscle meat) gelatin (obtained from chondrin of cartilage and bone) Fibrin (from coagulated blood) and globulin (from blood serum)

(a) Vegetable Proteins, such as gluten of wheat and cereals, and legumen from beans and pulses.

(2) Fats—Animal fats, fish oils, butter, etc. and vegetable oils.

(3) Carbo hydrates—Starch, Dextrine, Cellulose, Sugar, Glycogen etc.

(4) Mineral Salts—Sodium Chloride (Common Salt) Compounds of Calcium, Iron, Iodine, Phosphorus, Potassium, Magnesium etc.

(5) Extractives and Flavouring agents.

(6) Vitamins.

(7) Water.

Now, the three chief functions of food mentioned above are fulfilled by the different food-constituents in different measures:

1. The function of growth and repair of tissues (especially following recovery from wasting illnesses and starvation) is fulfilled by Proteins, mineral matter and water, and practically by these alone. (Now, although for the growth of nervous tissue glucose and lecithin, which consist of carbohydrates and fatty acids, are largely required for rebuilding them, these substances are almost incidental to the structure of the body, which in the main consists of Proteins, mineral salts and water).

2. The second function of food, viz., serving as a source of energy and work and production of the body-heat is mainly fulfilled by the fats and carbohydrates; and although it has been recognised by physiologists that proteins also are, by their oxidation to some extent capable of producing heat and energy, yet the preferential material for heat and energy-production are the carbohydrates.

Now, this use of food as "fuel" is closely connected with its use as building material, for it has been shown that the former function always takes precedence over the latter function; in other words, the demand for energy is satisfied first, then the demand for growth and repair is met. This is one main reason why, while discussing the adequacy of a dietary we give primary consideration to the value of foodstuff as the source of energy.

Now, the Temperature of the body is maintained at a remarkably constant level throughout life irrespective of the temperature of the surrounding air or medium. This phenomenon is an equilibrium maintained between heat-production through oxidation of food materials and heat-loss through urine, evapora-

tion of sweat from the skin or from conduction and radiation.

3. The third function of food, viz. that of regulating "the body-processes" is mainly fulfilled by vitamins and mineral salts It is known that heart-muscle, for example, cannot contract in the absence of proper amount of mineral matter. As mineral salts are also constantly excreted from the body by sweat and urine especially, they should be continually supplied to the system through food; further, it has been found that bone and teeth, which require Calcium and Phosphorus for their healthy growth, cannot assimilate these minerals in the absence of the calcifying vitamin (vit D.) in the food, though they may be present in sufficient quantity in the diet.

There are certain other processes of the body which are dependent entirely on the presence of mineral matter and vitamins.

[**The Hormones and the Enzymes.** The Hormones are produced by the so called "ductless glands," about which we shall have to speak later, but it may be mentioned here that Hormones consist of certain definite chemical compounds allied to the amino-acids, which, as we shall see later, are the products of the digestion of proteins. It is, therefore, clear that the production of Hormones by the ductless glands depends upon the presence of proteins which are capable of yielding the requisite amino-acids. Thus, the chemical formula of Tyrosine, one of the amino-acids produced by the oxidation of proteins is very similar to that of adrenalin, (the hormone of the ductless glands, the suprarenals). Like-wise the recently discovered, Thyrotoxin (Hormone of the Thyroid gland) indicates its probable derivation from the amino-acid, Thyrosine.

The **Enzymes** or ferments are the chief agents concerned in the chemical transformation of food involved in the process of digestion and assimilation. The enzymes are simple chemical substances and are capable of acting at relatively low temperature, but they are extremely active so much so, it is said that the amylase of the Pancreatic juice is capable of converting about four million times its own weight of starch into sugar. The energy contents, however, of the food materials, rather of the food

constituents are not in any way interfered with by the action of the Enzymes].

Having studied the functions of the various food-constituents we are now in a position to classify them on what is known as the Physiological basis—as follows:

(1) Tissue-formers—Proteins, mineral salts and water.
(2) Heat and Energy producers—Proteins (to a minor extent) fats and Carbohydrates.
(3) Protective Foods or Regulators of the various body-processes—vitamins and mineral salts.

In the above classification, it will be noted that Proteins appear under two heads out of the three, and we have seen that proteins are essential for the production of the hormones and the enzymes also. Proteins are, thus, of immense importance in diet and justify their title "pre-eminent" which the word, 'protein' signifies. In fact, without protein life is impossible, for the daily wear and tear have to be made good by them alone.

A diet may be predominantly protein and yet life can be healthily maintained thereon for a practically indefinite period as has been proved by the experience of the Eskimo, the Masai and the Red Indians of the Pampas Omit the protein from the diet and the body cannot last for more than a few weeks.

For generations proteins, fats, carbohydrates, minerals and water, which we saw, are essential for their tissue-forming value and production of heat and energy, formed the fundamental axiom of a proper ration until about thirty years ago, when, however, additional evidence could be adduced to show that these five proximate principles by themselves were inadequate and that a "mysterious something" more was equally essential. This "mysterious something" are the vitamins already referred to under the classification of the Food Constituents. It must be clearly understood that vitamins, whatever be their importance to the system have neither structural nor energy-value whatsoever and are incapable by **themselves** of sustaining life, but are really necessary for their stimulating powers on the body-metabolism (which the vitamins can only do in the presence of mineral salts) and in increasing the body's power of resistance to Disease; in

other words, an animal fed **exclusively** on vitamins cannot sustain life; and it is only through their absence in the diet does it become evident what part the vitamins play in the animal economy; also it will be shown later that continued absence of vitamins and mineral salts (such as those of Iron, Calcium, Phosphorus, Iodine) from the diet is the active cause in the production of general malnutrition and the so called Deficiency—diseases like Rickets etc.

The importance of Sunlight for optimum Health. Next to the essential requisites of a perfect diet for nutritional wellbeing it has been found necessary that the body be also frequently exposed to sunlight to ensure optimum health. It is well-known that plant life cannot go on in the absence of sunlight. The part played by sunlight in the animal economy has been dealt separately in Part I of this Book; but briefly said, sunshine has a stimulating effect on the production of the various Hormones and perhaps the enzymes also referred to already and it will be seen later that the production of vitamins. atleast some of them in our foodstuffs and also in our body is to a great extent influenced by sunlight.

We shall next examine in detail the use and mode of action of the various ingredients of food referred to already.

A. Proteins

These represent the structure of the body-machinery and their main use, as we have seen, is to build up new tissue as growth proceeds, to replace worn ones, and to a minor extent to provide energy.

Proteins are found both in animal and vegetable foods, but the animal proteins being akin to our body structure, are more easily digested and assimilated in larger proportions than vegetable proteins. Hence animal proteins like meat, milk, cheese, eggs, fowl and fish are much better articles of food than the vegetable proteins, such as cereals (rice, wheat, ragi, cholam, maize and cambu), pulses, (such as Bengal gram, Green gram, Black gram, Horsegram, Dhall, Soya beans and other kinds of beans and legumes) and certain nuts and fruits.

Now, Proteins, we said, are broken up in the alimentary canal into their constituents—the amino-acids; these are re-synthetised to constitute the appropriate portions of the body tissue until the needs of replacement and growth are met, the excess being burned or converted into body fat. As the body is not able to conserve and store protein in large amounts for future use, it is essential that the diet should supply a continuous and adequate amount to meet the requirements of metabolism. Now in order to meet the body s needs the proteins ingested must contain in sufficient quantity all the amino-acids required to synthetize the body-proteins and must be capable of digestion and absorption. Feeding experiments with proteins deficient in certain amino-acids indicate that there are at least five amino-acids which are essential for tissue formation and growth, viz. tryptophane, Lysine, Cystine, Tyrosine and Histidine. Various, proteins yield various amounts and kinds of amino-acids. Thus milk, containing casein, Egg-albumen and myosin of meat contain all the amino-acids entering into the composition of the body-cells in general. There are other proteins, however, which fail to yield any or yield only traces of one or more amino-acids. Such proteins may be said to be "incomplete" proteins; they are inadequate and their food value is practically nothing. For example, gelatine. It forms an inadequate source of amino-acids since it contains neither lysine, tryptophane nor tyrosine essential for growth; so also zein, a vegetable protein contained in maize, has no lysine nor tryptophane.

It is, therefore, important in judging the food-value of proteins to take into consideration their capactiy to break up into the various amino-acids essential for normal growth; and if a protein lacks in the amino-acids (like lysine, tryptophane and tyrosine) which are essential for the manufacture of the body-proteins, that protein is absolutely useless to the body. It has been found that, as a rule, animal proteins (with the exception of gelatin) contain a large quantity and variety of amino acids suitable to form the body-protein, while vegetable proteins have considerably less. It, therefore, follows that animal proteins contain better nutrition than vegetable protein.

[What is known as the **Biological value** of foodstuffs is applicable only to proteins. By the term is meant that property of proteins by which they can replace the wear and tear of the body; thus, when we say that proteins of milk have a high biological value or that the proteins of wheat have a low biological value we understand that milk protein can supply the requisite material for growth and repair at a lower figure for intake than can the proteins of wheat. Proteins of low biological value, have, therefore, to be supplied in much larger quantity than proteins of high biological value in order to meet the demand of the cells. All animal proteins have a high biological value and all vegetable proteins have as a rule, a low one].

The common cereals like rice, wheat, millets and barley do contain a fair proportion of Proteins; but of all cereals rice is the poorest in the matter of proteins. In the case of rice and wheat the outer layer of the grain contains the largest percentage of Proteins and salts of calcium, iron and vit. B. so that when they are **highly milled** these substances are lost from the grain. Milled rice, therefore, loses some of its proteins, but most of the salts and practically all the vitamins. Hand-pounded rice is, therefore, much richer in respect of proteins and also salts than milled rice; and hand-pounded parboiled rice is richer than hand-pounded raw rice.

In the case of the wheat also, the outer layers of the grain are rich in salts (Ca. P. and Fe.) and vit. A, B_1 and B_2. Hence whole wheat is a much better article of diet than the refined wheat flour—white flour or American flour; and wheat is in all respects (in respect of proteins, salts and vitamins) much richer and better article of food than rice.

Pulses, such as Bengal gram, black gram, green gram, dhall, horsegram, soyabeans are also rich in proteins, salts of Ca. P. and Fe. and most of the pulses are rich in vit A, B_1 and B_2 also.

It is clear, therefore, that most of our staple articles of diet like cereals and pulses contain Proteins, salts and vitamins though in varying proportions, but their proteins are mostly lacking in tissue-forming proteins. This deficiency has therefore to be

made good by an adequate amount of milk, eggs or meat. Sugars and oils(cod liver oil, butter, red palm oil, cocoanut oil, groundnut and gingelly oils) are wholly devoid of proteins. Roots and leafy vegetables and fruits are rather poor in proteins but they are useful and necessary for the system and should form part of our daily menu for the better utilisation of the proteins contained in the diet.

Growing children and women in pregnancy and lactation (suckling mothers) should receive a larger proportion of proteins in their diet than ordinary adults, as proteins are most essential during the period of growth.

Proteins contain nitrogen and are therefore called "nitrogenous" food stuffs. In this respect they differ essentially from carbohydrates and fats, as the latter contain no nitrogen. Now, nitrogen enters largely into the composition of muscle tissue, and muscle therefore, depends for its growth and repair on nitrogenous foodstuffs like proteins, in fact proteins alone are capable of supplying both energy and materials for growth and repair, as we have already seen.

It will be shown later that one of the commonest errors in the dietary of the young and growing children in India, consisting as it does essentially of wheat or lesser cereals like rice, ragi, cambu and maize, is the deficiency in the diet of suitable proteins such as of milk and milk products or eggs or meat or fish or fowl and deficiency of green leafy vegetables and fruits (Protective elements, —vitamins and salts).

This is due to several factors, primarily to their cost and secondarily, to the religious objection of certain sects of Hindus, Buddhists and Jains for animal products like meat, egg and fish, although they have a partiality in this regard for milk alone or its products. Now, milk and its products-(curds, butter milk, cheese) may however, form an efficient substitute for eggs and meat, but it has to be supplied in suitable quantity and if this is done and sufficient supply of leafy vegetables and fruits also be made most of the deficiencies of the rice or wheat diet would be suitably balanced. Physiologically, it has been found that proteins of high biological value like meat, milk and eggs raise

the biological value of poorer proteins when mixed with them. This is an important principle, which we shall refer to again while discussing the comparative value of animal and vegetable proteins. Other means of supplementing the chief defects of wheat or rice or millet diets will be referred to under the appropriate headings.

We mentioned above that muscle depends for its growth, repair and activity mainly on proteins and it naturally follows that if proteins are withheld from diet the muscular structure of the body should especially suffer. Prolonged deficiency of proteins in diet, therefore, leads to a general state of muscular under-nutrition, poor physique, lack of vigour with decrease in labour efficiency; labourers become fatigued more easily and there is a disinclination for muscular exertion; there is likewise a similar apathetic attitude toward mental work also.

An increased susceptibility to catch cold (from deficient production of heat) is common, reproduction falls off, power of endurance of fatigue wanes, so also the power of resistance to diseases like Tuberculosis, Leprosy, certain types of anaemia, venereal disease etc.

Now it should be noted that during prolonged fasting also there are likewise a pronounced reduction in heat-production extreme muscular weakness mental apathy and a diminution of sexual expression.

To sum up. We have seen that animal proteins are more easily digested and assimilated as animal proteins are akin to our body structure; that they are more easily capable of breaking up into the various amino-acids essential for growth and repair; and that they are, therefore, superior to vegetable proteins, as the amino-acids contained in the vegetable proteins are not present in the same relative proportions as those found in animal proteins, so that when vegetable proteins are converted into body-proteins there is apt to be considerable wastage, which is not the case with animal proteins, in the latter the amino-acids being more abundant. Nevertheless it has been found by experience that the best physique and power of endurance are equally possible from a purely vegetarian diet including milk

and its products. Physiologists have of course offered the explanation that milk proteins of high biological value raise the biological value of the poorer vegetable proteins when mixed with them in diet.

Chevers, the pioneer surgeon of Calcutta whose name is ever associated with his monumental work on Indian Medical Jurisprudence, wrote exactly a century ago about the dietary of the Hindus as follows: "It is certain that the law-givers who prescribed for the people of India a diet consisting mainly of vegetables (vegetable food is meant) and water, the lighter kinds of animal food such as fish, pigeons and goats flesh being only occasionally introduced in moderate quantity, judged almost as physiologically as they could have done had they studied at the feet of Liebig and Prout." Further, in the discussion of the dietary of man the meatless diet of some of the finest soldiers of H. M's Indian Army, who fought in the last Great War of 1914 was highly extolled. This is an interesting subject for research in the quest of the minimum animal protein required for human consumption and the future Scientists may show that it is perhaps influenced by climatic conditions.

B. Carbohydrates

They are the chief source of energy and are essential for the characteristic processes underlying muscular activity and activity of the organs and glandular structures. Hence they form the chief fuel, as we have already seen, for the body-machinery. They have a leading place among the solid ingredients of diet as the amount normally present in the body is very scant.

Now, carbohydrates, it will be seen, form the main elements in the diet of practically all nations of the world except those living in the Arctic regions, in whose diet fats do normally preponderate from climatic necessity; moreover, vegetable life, which is the main source of carbohydrates, is scarce or even impossible in these cold regions.

Carbohydrates are mainly classed as the **sugars** and the **starches**. Simple sugars are among the standard substances which the body tissues can use, and as most of them are freely

soluble in water and of simple chemical composition they are readily absorbed. Thus (1) **glucose** (or dextrose) found in fruits especially grapes and in animal-blood, and also (2) **Fructose** (or levulose) found with glucose also in fruits are most easily and most completely absorbed in the tissues and do not require previous digestion as in the case of starches. Also (3) **sucrose** obtained from sugarcane, beetroot, palmyra, datepalm and some varieties of dahlia-bulbs, and (4) **lactose** (milk-sugar) from milk and (5) **maltose** (malt-sugar) from malt are examples of simple sugars capable of direct absorption from the food more or less in their natural state, that is as they exist in the food-stuffs. In fact in extreme collapse from exhaustion, choleraic diarrhoea, loss of blood as after delivery, pure glucose in solution can be injected directly into the blood-stream and is the only foodstuff with the exception of sodium chloride that can be so injected. At present there are so many preparations of glucose in the market, the most easily soluble being Dextrosol. About ½ oz. of Dextrosol in about 4 oz. of water duly sterilised by boiling can be safely injected into the bloodstream.

Fresh fruits, such as Pears, Plantains, Pineapple, Mangoes, Pomegranates, Papaya and dried ones such as Dates, Raisins, Figs do contain a large amount of "sugars;" sugars contribute nothing other than mere calories or heat-units to the system. Wherever possible less highly refined forms of sugars such as **jaggery** and **molasses** should be used, since these are rich in Ca, Fe and even contain some vit. A. **Sweet toddy** contains only sugars in solution and is not intoxicating unless fermented. **Honey** is a form of sugar (invert sugar) obtained from flowers and is a good substitute for sugars. (Invert-sugar is a mixture of equal parts of Dextrose and Levulose and is obtained from canesugar (sucrose) by boiling with the addition of an acid). **Starches** are forms of carbohydrates present in foodstuffs such as grains (cereals and pulses) roots and tubers (Potatoes, Tapioca, Arrowroot, Sago, Yams and Colocasia) and nuts. Starches are purely of vegetable origin and their grains (starch grains) have an outside covering of cellulose, which forms the basis of the woody fibres of plants.

As starch is insoluble in cold water there is no risk of its

being washed away by water or rain if the plant should be injured; but when boiled in water the cellulose covering becomes softened and ruptures and the starch grains become gelatinised, in which state only they are digestible by the human stomach.

Unripe fruits are hard and woody from the presence of a cellulose-frame work; in the process of ripening the acids in the fruit aided by the heat of the sun effect a softening of this frame work with partial or complete solution of the cellulose fibres, the product being the sweet soft ripe fruit.

Starch is really made up of minute grains and under the microscope present various shapes depending upon the plant or fruit or tuber from which it is derived.

Sugars after absorption from the alimentary tract are converted in the liver and the tissues into "**glycogen**" and to a lesser extent into **Dextrine**; glycogen can, therefore, be called animal carbohydrate or animal-starch, and liver is the only meat (animal flesh) that contains glycogen, but some kinds of fish and oysters also do contain glycogen.

[Dextrine is a gummy substance and is familiar to any one as the sticky material on the back of postage stamps; outside the body dextrine can be prepared by subjecting starch to a high **dry** temperature as in frying without oil or fat as we do in preparing potato-chips. Toast and crust of bread consist of starch converted into a **soluble form of starch** and **dextrine**]

Now, the regulation of the glycogenic function of the liver and the tissues has an important bearing on the production of Diabetes, which is unfortunately one of the greatest scourges of our race, and constant use of large quantity of highly seasoned or sugary stuff in the diet brings about the condition especially among the rich from overeating and from want of exercise, the other factors helpful in the causation of the disease being sexual abuse and excessive use of alcohol, coffee and tea.

Now, meals containing a large amount of sugar such as sweets, jams, chocolates etc. are not easily digested and are apt to ferment in the stomach and the Intestines producing pain, discomfort and flatulence (windiness) with palpitation and even cardiac distress. It has been estimated that nearly 70—80 p. c.

of cases of chronic dyspepsia are due to habitual use of sweets. Icecreams often make one "scream" with pain. Even a large quantity of rice or other carbohydrate-food in the diet interferes with the absorption of other elements—such as the proteins, salts and vitamins - of the food. On the other hand, vitamins especially vit. B_1 and B_2 have been found to be absolutely essential for the proper utilisation of carbohydrate food in general. Carbohydrates and vitamins are; therefore, interdependent on each other for their absorption. Habitual use of too much of carbohydrates in the diet of children is apt to produce Infantile Biliary Cirrhosis of the liver, as children are unable to digest them by reason of absence of certain digestive ferments (Ptyalin of the saliva and amylase of the Pancreatic juice) in them. Often a form of a-vitaminosis manifests itself in children in the shape of certain eye-affections (see later—vitamin-deficiency diseases).

Cellulose is allied to starch and forms, as we said, the ground work of all vegetable fibres; but it is not affected by boiling as starch is, and cellulose does not undergo any change by the action of the digestive-juices of man; and if cellulose undergoes any digestion at all it is due to the action of the putrefactive bacteria normally present in the Coecum (part of the large Intestines) giving rise to certain fatty acids and foul gases, and these acids have an irritant effect on the bowels, thus preventing constipation.

One important use of cellulose in the human economy should, however, be mentioned here: cellulose being practically indigestible provides with the undigested portion of food the "roughage" or ballast to the contents of the larger bowels, which is absolutely necessary for their daily evacuation; cellulose is, therefore a mild laxative acting on the bowels as a mechanical stimulant. Similar action on the bowels is produced by indigestible husk of grains and skin of fruits; Sea-weed agar also acts as a laxaitve in this manner.

It has been observed that if herbivorous animals are fed on a diet which leaves little residue or no residue they will suffer from intestinal affections; even in the case of man a diet which is

practically completely assimilated is prone to bring about intestinal disturbances; on the other hand a diet which leaves behind a very large residue is not only wasteful economically but demands for its manipulation and disposal an undue amount of muscular and nervous energy on the part of the intestines. This is one of the drawbacks of a purely vegetarian diet. On the other hand, a vegetarian diet has its own advantages: it prevents chronic constipation and intestinal "stasis" with their accompanying condition of auto-intoxication (intestinal toxoemia) from absorption of the products of decomposition in the intestines, and to a large extent diseases like sprue and appendicitis, these diseases being mostly common among meat-eaters, because the residue left by the digestion of meat is not sufficiently bulky and is more toxic than the residue of a vegetable diet. Constipation is almost the normal condition among those European residents in India and the Tropics who still continue their native meat-diet of the temperate regions.

In conditions of disease it may be necessary to take advantage of the behaviour of different foods. In constipation, especially of the chronic type it is important to supply a large amount of ballast by giving green leafy vegetables and fruits and even articles leaving large residue such as wholemeal bread and agar. On the other hand in diarrhoea foods like rice, arrowroot, milk and bread which leave little residue behind after digestion are usually prescribed. Incidentally, such foods are digested by the stomach and the intestines with comparative ease also.

C. Fats

[The word 'fat' as used in the anatomical sense means "adipose tissue."]

Fats are important articles of diet providing a large amount of energy by their combustion (oxidation), that is, they have a high caloric value. Carbohydrates and Proteins are nearly always associated in food with relatively large amount of indigestible matter such as cellulose and have, therefore, to be taken in large quantities to supply the necessary energy; but fats are present in food in a high state of concentration. Fats have,

therefore, this advantage over carbohydrates and proteins. Fats, moreover, are readily stored and laid down in the subcutaneous tissue, where they make an efficient protection against loss of heat and serve as a store to draw upon in time of need. This method of storage of energy by the body is, indeed, the most economic of space.

Fats are contained in animal foods like Cod Liver Oil and other fish oils (Shark oil, Hallibut oil) and butter and ghee. All these contain vit. A in abundance, while most of the vegetable-oils contains litfle or no vitamins although the oil-seeds or nuts from which the oil is expressed may contain vitamins to some extent. There is one vegetable oil, however, which is very rich in vit.A and that is the oil obtained from the fruit of Elacis guineensis, a kind of palm grown in Africa, Malaya and Burma. The oil is called the "Red Palm oil," the oil being red and not the palm.

Among the vegetable food stuffs containing fats may be mentioned nuts of various kinds, cocoanuts, almonds, cashew-nuts, groundnuts and walnuts.

Fruits contain very little fats with the exception of the Avocado-pear (butter-fruit) which is at present extensively cultivated in Coorg and lately introduced at the Govt. Agricultural farm at Coimbatore and the Fruit-growing (Pomological) Station at Coonoor the Nilgiris. It is said to contain about 22 p. c. of fat. Oatmeal, Bijra or Cambu, Soyabeans, Almonds, Bengal-gram, Cashewnuts, Groundnuts and Walnuts do all contain a varying amount of fat and of vit. A, B_1 and B_2 also.

Fats are insoluble in water but pass from the solid to the liquid state at moderate temperatures. They consist of compounds of C, H and O, (that is why they are called Hydrocarbons,) but no Nitrogen in their pure state. They are, therefore, non-nitrogenous (unlike proteins) and as the greater portion of our body tissues like muscle are nitrogenous fats by themselves are incapable of sustaining life long.

D. Water

Water enters into the composition of all the animal tissues including bone and constitutes about two-thirds of the entire

body weight. Even bone contains about 50 p. c. water. Water supplies fluid for the secretions, digestion and metabolism (tissue activities), also for transfer of food constituents and helps in the elimination of effete material. It plays an important part in heat-regulation and next to air is the most necessary principle of life.

Under normal circumstances the amount of water in the body remains the same even though the intake of water may vary considerably. If the intake of water is increased the blood pressure in the renal blood vessels rises and the secretion of urine increased; but if the amount of water is decreased thirst is produced, to quench which more water has to be taken in. Thirst is a demand of our system that the water intake should be increased. It is, therefore, advised except under exceptional circumstances (such as high blood-pressure) that the body should recieve a liberal supply of water. It keeps kidneys and the skin active and serves to dilute any extraneous matter accumulated in the blood, which might otherwise irritate the kidneys especially and bring about their disease; poisons of fevers and disease, excess of sugar or salt contained in the blood are thus washed out of the system mostly by urine and to a lesser extent by sweat. This is the reason why fevers, diabetes or in take of a large quantity of salt or of alcohol produce thirst, which is an indent for an extra quantity of water to be taken as drink.

Water is absorbed directly from the alimentary canal mostly by the small intestines without previous digestion, and with the water the soluble salts and sugars from food as we noted above. The need for inclusion of salts and water in the diet results from continuous loss of both these substances from the body by the urine, the sweat and through the expired air. Considerable quantities of salts and nitrogenous wastes are lost by urine and sweat but no salts are seen to be lost through respiration.

Experiments on animals have confirmed these observations: "If an animal is fed on a diet free from salts the excretion of urine is practically free from salts; while, if the water in-take is also restricted the excretion of urine may be prevented altogether for several days."

It is difficult to estimate how long a person can survive if he were allowed to drink no water at all. Since the rate at

which water is lost from the system varies directly with the amount of work and the outside temperature and humidity of the weather, under ordinary circumstances of comparative rest it would be a matter of several days. But it must be remembered that most of the common articles of diet do contain varying amounts of water and that some foods are capable of producing water during their oxidation, so that the period of survival might be said to depend upon the nature of the food also.

E. Neutral Salts

The tissues of the body usually contain the elements Fe, Cu, Ca, Na, K, Mg, P, S, Cl, I, Fluorine and Silicon, and they are present in the form of their neutral salts. They are essential ingredients of nearly all the substances used as food. But a diet that does not contain vegetables and fruits can be said to be practically lacking in many of the salts, especially those of Ca, Fe, and P.

The important functions of the neutral salts are that they form the essential constituents of all tissues of the body. Thus, Fe and Ca, are the chief constituents of Haemoglobin, the red colouring matter of the blood which acts as the oxygen-carrier to the body. Salts of Na, K and Ca are concerned in the maintenance of alkalinity of the blood and also in the keeping up of the tone of the visceral muscles as of the heart and intestines.

The coagulability of blood is dependent on the presence of calcium salts in it; Ca also forms with P an important ingredient of bony tissue.

Sodium Chloride furnishes the hydrochloric acid of the gastric juice, and several other salts do contribute towards the alkaline medium in which both the pancreatic and intestinal juices act and towards the production of bile salts.

Magnesium salts and probably Ca. also help in toning down the irritability of nerves, and P is an important constituent of nerve-tissue itself.

P and S are generally contained in almost all kinds of proteins especially that of meat and fish, and of Cereals and Pulses.

Most of the salts of Fe, Ca, P and I are organic in nature, and as such they are much more easily absorbed into the system than the inorganic salts of the same elements. This fact is of significance in the treatment of certain forms of anaemia with Fe salts that they have to be supplied in these cases preferably in the form of organic compounds of Fe.

Iodine is the active constituent of the Thyroid gland—hormone and is the important element that has to be supplied to the body in cases of Thyroid insufficiency, giving rise to certain diseases such as goitre and myxoedema.

Fluorine and Silicon occur in bones and teeth contributing to their strength and rigidity.

Distribution in Nature. Calcium. Foods containing Ca. are milk and its products (buttermilk, whey and cheese) Eggs, Bran, oatmeal, Dhall and fruits and green leafy vegetables. Women in pregnancy and lactation and growing children do require these foods very much in their daily needs. Too little calcium is the cause of the decay of teeth, of osteomalacia (softening of bones) with distortion of the limbs, rickets and certain forms of general malnutrition.

Phosphorus is contained in milk, butter milk, cheese, eggs meat and fish, dhals, wheat, soya beans, ragi and cholam and vegetables like spinach, radishes and cauli flowers.

Deficiency of Phosphorus interferes with the nutrition and structure of bone and teeth.

Both P and Ca should always be present in combination for perfect bone and teeth, and this combination is yielded best by milk, eggs, dhals, green vegetables, spinach, brussel sprouts, potatoes and fruits.

During pregnancy and lactation in the absence of sufficient Ca salts in the diet the bones and teeth of the mother are frequently drawn upon to supply this factor to the child with resulting demonstrable damage to the mother.

Iron (Fe) is contained in liver meat, eggs, unmilled cereals, amaranth, spinach, tomatoes and radishes, and friuts like peaches, apricots, prunes etc. Deficiency in Iron in diet brings about anaemia and general weakness with inability to work. The

assimilation of Fe. from foodstuffs has been proved to depend upon the presence in them of certain salts of Ca and vit, A, B, C, E and also an unknown principle secreted by the liver.

Iodine (I) is obtained from sea-weeds and is contained in agar. Seasalt contains Iodine and should therefore be preferred to Rocksalt in those parts where goitre (Derbyshire neck) is prevalent. It is a common saying in Northern India that those who can afford the luxuries of tablesalt (seasalt) do not get goitre. Common shoe-flowers (Hibiscus rosa Sinensis, chembaratti flowers) and some varieties of colocasia and coleus are said to contain Iodine in a fair amount.

Now there is no single food which contains nearly all the salts and in the right proportion and milk is the only exception, but even milk is deficient in Iron. Leafy vegetables, tubers and root vegetables and fruits are rich in salts; while, meat, dhall, cereals and pulses and nuts are comparatively poor; and over-milled rice and white wheat-flour are very poor.

Hence, when our food consists largely of cereals such as wheat, rice, cambu, ragi etc., and even with meat diet there is always the need to take plenty of milk, vegetables and fruits to secure the necessary amount of salts. This point will be further referred to when we come to discuss the defects of the Indian Dietary and the means of correcting them.

Experiments have proved that if an animal is fed exclusively on a diet of **Salt-free** materials it dies within about 20 days, more quickly in fact than if it were completely starved. This is explained by the fact that the reserve of salts and water normally present in the body-tissues is all drawn upon when no salts are supplied to the body through food.

As a rule all foodstuffs in nature containing salts in plenty are rich in vitamins also, and as already remarked the absorption and assimilation of salts is advantageous to the system only in the presence of vitamins especially vit. A, C and D. Thus fat fish contains vit. A and D and Iodine; yolk of eggs, vit. A and D and Iron; liver, vit. A and Iron; cheese and milk supply vit. A and Calcium and Phosphorus; watercress or greens (amaranthus) yield vit, A and C and Iodine and Iron.

Before we finally leave off the subject of 'neutral salts' we might refer to one important use of these salts in the treatment of certain diseases. We mentioned that one of the functions of these salts, especially those of Sodium, Potassium and Calcium is to keep up the alkalinity of the blood and the tissues. Now in certain forms of fevers, rheumatism and gout, there is a tendency for the natural alkalinity of the blood and tissues to diminish, and such conditions are usually met by the administration of plenty of water with fruits and vegetable juices and complete avoidance of meats.

It may be pointed out here that almost all the salts are soluble in water. This is an important point to remember as in cooking vegetables most of the salts do pass in the gravy, which should not be thrown away but may be utilised as vegetable soup; this is the reason also why potatoes, for example are to be cooked in their skins. Steaming is thus the best method of cooking rice and cereals and fruits. To avoid loss of salts by cooking and also destruction of vitamins, especially vit. C it is safer to use some part of the vegetables and all fruits without cooking but after thoroughly washing in clean cold water several times – "Unfired food."

Common Salt (Nacl.)

The prominence given to salt in the phrase and fable of the East is difficult to be understood by the inhabitants of Temperate climates, where salt ranks merely as one among the condiments, but in the East it is one of life's necessities—the salt of the Earth is second only to the water of life. Indeed the Gods in Egypt have been worshipped from ancient times as the givers of "bread and salt." With animals it is of even greater importance; big game can often be induced to forsake an ancient drinking-pool simply by moving a block of rock-salt, and no herd of cattle is without its "licking" stone.

In temperate climates this need for salt is not apparent, because there is ample in the meat diet of their inhabitants to balance the loss by excretion. In the tropics, however, its

importance is reached when it is remembered that in the least oppressive circumstances a man may lose by sweating alone as much salt as he normally absorbs from his diet. The average volume of sweat alone in the hot weather in India is about 12 pints and this amount is found to contain about 300 grains of sodium chloride. Taking into consideration the amount of salt excreted in the urine, it may be safely said that the average daily requirements of salt in a Tropical climate are atleast 500 grains, and if the amount of salt supplied in the diet falls short of these requirements there will be considerable deficit, which has to be drawn upon from the tissue-reserves. The result is ill health, languor and loss of efficiency both for bodily and mental work.

McEvan attributes this vague health and loss of efficiency of the white residents of the Tropics to the deficiency of salt in the dietary and consequent depletion of the tissue reserve.

This state though differing in degree is similar to that giving rise to the severe miner's cramps described by Prof. Moss when the fluid lost by excessive sweating is replaced only by water.

Langdon Brown draws attention to another and severe form of this condition commonly met with in the Tropics (and which he calls Hypo-adrenalism) the symptoms of which are similar to those of Addison's Disease (morbus Addisoni), viz., pallor, lassitude and extreme weakness and irregularity of the heart's action, want of appetite (from the digestive juices not being formed in proper amount for want of sodium chloride) and sleeplessness. The condition is due to severe deficiency of common salt in the diet and readily responds to a free supply of it.

These observations show that the large proportion of the effects of torrid climates, which are necessarily most marked among the hand labourers and miners in the Tropics can only be avoided by sufficiently increasing the salt-intake.

Common salt can therefore, be pronounced to be an absolute necessity for life and cannot be denied to man without grave danger of ill health and incapacity or death. And it is strange that even in civilised countries government consider

salt as an article on which an excise duty can be imposed as though it were an article of luxury like alcohol or an intoxicant like opium or ganja, unmindful of the economic hardship caused thereby to the poor labourer.

Common salt is essential for the manufacture of the Gastric juice and the Hydrochloric acid contained therein.

Salt is a common preservative of foodstuffs like meat, fish and vegetables.

Salt-free diet. In chronic Bright's Disease where the kidneys are inflamed and are consequently unable to excrete sodium chloride freely by the urine, the salt taken with food is retained in the system; and in order that the normal composition of the body-fluids may be maintained water also is kept back with the result that dropsy sets in. Now if the salt in-take is reduced to nothing, in other words if no common salt is taken with the diet the salt that has accumulated in the dropsical fluid is drawn upon to make good the deficiency (of salt) in the blood and with the withdrawal of the salt the dropsy also subsides. Physicians, therefore, prescribe a salt-free diet in all cases of dropsy due to kidney disease and even diseases of the Heart and the Liver.

F. Vitamins

It has been found by experiments that animals fed entirely on Proteins, Carbohydrates, fats, salts and water—all possessing a high degree of chemical purity, do not remain in good health; similarly it has been observed that in man the omission ot certain constituents of normal diet results in disease—the so-called "Deficiency-diseases;"—and subsequent inclusion of the missing constituents (or even their extracts) results in most cases in recovery. These missing substances are the 'vitamins' mentioned above, which are in so much fashion now a days as to become a craze.

Vitamins, however, whatever may be their virtues, have no structural or energy value whatsoever, in other words, no amount of vitamins alone in the diet can promote normal growth and maintain normal health without the necessary quantity and quality

of Proteins, Carbohydrates, fats, salts and water. Infact it has been proved beyond doubt that the assimilation of these various elements of foodstuff is, to a large extent, dependent upon the presence of vitamins. Thus, vit. A and B are necessary for the proper metabolism of Proteins and fats, vit. B of carbohydrates and vit. A, C and D for helping the absorption of mineral salts. Now, since a supply of vitamins is essential for the animal body they are generally present in the natural foods which are instinctively consumed by man or animals.

In the tropics where carbohydrate foods are consumed in excess the need for vit. B is much more pronounced than it is in colder climates. The wider prevalence of gastro-intestinal disorders in India may have some sort of relation with vit. B deficiency. Hence it is advisable to supply even an excess of vit. B in the dietary, otherwise the body-metabolism may fail and throw an excess of strain on the system especially during pregnancy and lactation and in the case of growing children. The occurrence of infantile-cirrhosis of liver is perhaps explainable in this way.

Our knowledge of the vitamins has been largely acquired by the study of the disease Beriberi; and the discovery of vit. B, as a causative factor of the disease from its deficiency in diet can be said to have effected marvellous changes in the health of individuals and of nations, and one of the first Reforms leading to the emancipation of modern Japan, for example, from her mediaevalism of half a century ago was concerned with a problem of this sort. The Japanese Army had been reduced to complete ineptitude by the prevalence of Beriberi among the crew, as more than a quarter of the men were afflicted. Baron Takaki from the study of the dietary found it to be very imperfect and instituted improved rations with complete success.

Beriberi was until recently a terrible scourge in the Malaya States, was often seen among coolies at seaports and had broken out in an Asylum at Dublin. Improvement of the quality of food in the prisons of the Strait Settlements had failed to limit the disease.

The outstanding peculiarities of the incidence of Beriberi

in the Strait Settlements, was that while the Tamils were exempt, the Chinese suffered severely. Rice is the staple food of both the races but with this difference, viz. that the Tamils used parboiled rice while the Chinese used husked white rice. The Chinese are extremely prone to Beriberi, while the Tamils very seldom suffer. This cannot be due to any racial peculiarity as the Tamils in prison fed on the same rice as used by the Chinese also suffered. The substitution of parboiled rice for polished white rice in a Siamese prison brought down the death rate from 113 to 0 in 1930.

The immediate relation of Beriberi to vit. B, was first pointed out by Dr. Eijkman, a Hollandish doctor who made a special study of Beriberi in the Dutch East Indies, and his work obtained for him the Nobel Prize for 1930.

Vitamins, however, are not quite unknown to Hindus; the ancients had evidently known by experience about the existence of these food elements and their importance in the matter of good health, although they were not able to demonstrate their chemical or Biological nature now made possible by modern means. The use of sprouted green gram (Phaseolus Radiatus) and the tender greens of the Agasthi Keerai (Sesbania grandiflora) and Ekpani (one leafed shrub - ondalaga-Hydrocotyle asiatica)has long been prevalent among the Hindus as the most essential means of breaking the fast of Ekadashi the next morning. So also the use of leavened preparations like Surnalies and Iddalies, varieties of sponge cakes.

At present there is evidence of the existence of only six vitamins, usually represented by the letters A, B_1, B_2 (or G or P.P.), C, D and E (or X) respectively and written -- vit. A, vit. B_1, vit. E etc. and it is possible that in course of time as laboratory methods get more and more perfect more vitamins may be discovered until one day we might reach the end of the alphabet.

1. **Vitamin A.** (Antixerotic, anti-infection Fat soluble A). This is found mainly in animal fats (except lard and baconfat), fish-oils (like Cod Liver Oil, Hallibut Oil, Shark Oil etc.) butter, yolk of eggs, Liver of animals, birds and fish, Heart and Kidneys, whole milk and cheese (especially milk derived from grass-fed

animals which is rich in vit. A and even richer than Cod Liver Oil), green vegetables like spinach, lettuce, cabbages, Brussel's sprouts, greenpeas, amaranthus (keerai), agasthi keerai, moringa (murungai, Pterygosperma moringa, so called from their winged seeds), string beans etc.; fruits like ripe tomatos, bananas, dates contain a fair amount of vit. A; and tropical fruit papaya is exceptionally rich in vit. A; next come mangoes, apples, figs, oranges, lemons and grapefruit; pineapple contains small but appreciable amount of vit. A.

Vegetable oils are, as a rule, deficient in vit. A, except the red palm oil, which is a rich source of this vitamin.

Milk, butter, cream and fruit juice containing as they do vit. A are the chief source of it for children; so also all liver fats like Cod Liver Oil. There is a variety of fish—Vetki—obtainable in Madras and the East Coast, which has been found to be far richer in vit. A than even Cod Liver Oil or Hallibut Oil. Cereals are in general rather poor in this vitamin except yellow maize and greenpeas, which contains an appreciable amount.

In nature vit. A is usually associated with the yellow pigment (carotene) contained in yellow vegetables like carrots, pumpkins, squash, yellow sweet potatoes, apricots, peaches, oranges and tomatos, all these are rich in vit. A; while white potatoes, onions, radish, beetroot contain little or none.

An adequate supply of this vitamin is essential for satisfactory growth in children and for increasing the power of resistence to infection; nursing mothers require a generous supply, because even if the breasts do secrete this vitamin in their milk it is done at the expense of the mother.

Vit. A is not easily destroyed by boiling except in the presence of an alkali. Crude Cod Liver Oil is, therefore, much richer than refined Cod Liver Oil, as evidently most of the vitamins are destroyed during the process of refining probably from very high temperature or admixture with alkalies.

Diseases due to vit. A. Deficiency The chief diseases caused by deficiency of vit. A in diet are:

(1) Xerophthalmia (or Xerosis). It is possible also that deficiency in diet in other directions such as proteins and

salts may act as an adjunct cause. In this disease the conjunctiva of the eyeball becomes pigmented or even jaundiced, **dried** (as the term "Xerosis" means) and lustreless and appears covered with a material resembling dried foam. In South India the disease is termed 'Karpam'' and has been associated with malnutrition and some form of chronic itch. Associated with the disease there is usually **night blindness** of a functional nature. It is not only on account of the pigmented appearance of the conjunctiva but to the condition of night blindness also that Xerosis is called **karpam** as mentioned above.

The condition, Xerosis, has been thought to be due to deficiency of vit. A for several reasons: it has been experimentally produced in animals by withholding vit. A from their diets and proved to be curable by giving Cod Liver Oil or Mammalian Liver or birds' liver, which, as we saw, are rich in vit. A. Dr. Aykroid, at present Director of the Nutritional Research Laboratory, Coonoor, described the following observations made in Newfoundland and Labrador in the summer of 1929; the diet of a series of cases of Xerophthalmia with night blindness was found to be obviously defective in vit. A; in some patients the disease developed in less than a month after the patient had passed from a diet rich in vit. A to one which was totally devoid of it. The condition of the country and the mode of life followed by the people made it difficult or impossible to obtain proper food. All these cases were curable, especially the night blindness by one or two doses of Cod Liver Oil. Two fishermen, Aykroid says, had cured themselves by eating half a sea-gull's liver, and Liver is, as is wellknown a time honoured specific for night blindness, and Hippocrates, Father of Medicine in the West, recommended that "the patient should eat once or twice as large an ox-liver as possible, raw and dipped in honey."

(2) Another common manifestation of eye disease due to vit. A deficiency is Keratomalacia (literally meaning softening of the cornea) which consists in the softening of the cornea of the Eye and its complete destruction resulting in complete blindness. This disease is also due to lack of vit. A in food and occurs mostly in children after the first year of life, but may also be found in

older children and rarely in adults over 20 years of age. The child usually suffers from extreme emaciation and diarrhoea enlarged liver and spleen; there is accompanying condition of Xerosis, so much so that Keratomalacia may be considered to be an advanced stage of Xerosis. The child is apathetic and is unable to close the eyes, gradually the cornea becomes softened and peels off resulting in an irreparable form of blindness.

Keratomalacia is possibly the most serious cause of preventable blindness in South India and in any case is more serious than Ophthalmia Neonatorum, (a condition of purulent conjunctivitis occurring in the new-born infant as a result of gonorrhoeal infection of the eyes from the mother's birth canal). In Bengal and Bombay the same view is held by eminent Eye Surgeons, but in the Punjab which is peculiarly free from deficiency diseases as a rule, the incidence of Keratomalacia is negligible; on the other hand in the United Provinces of India the position of this complaint is the same as in Madras and Bombay or Bengal.

One of the great differences between the Punjab and other Provinces of India, which influences the occurrence of Keratomalacia is that the food in the Punjab gives a more complete diet, the inhabitants being largely wheat-eaters and not rice-eaters as elsewhere; moreover, the Punjabis consume large quantity of milk or milk products like butter, curds and ghee and other vitamin--rich foods. Hence, possibly there is very little deficiency disease in the Punjab.

Col. Wright of the Govt Ophthalmic Hospital, Madras, has collected statistics of the incidence of Keratomalacia. He says that blindness is a much more common sequel in Keratomalacia than in ophthalmia neonatorum, in fact it is much rare to lose an eye from the latter disease unless the cornea is already badly damaged when the case reports to treatment.

(3) There is one variety of eye disease—Angular conjunctivitis—commonly met with in badly nourished young individuals associated with Xerosis and night blindness and also chronic soreness of the mucous membranes in general especially of the mouth and tongue, with excoriations at the corners of the mouth and hoarseness of voice from involvement of the larynx.

[The author has personally seen several cases of this type in some of the Boarding Schools in Tanjore while in charge of the Govt. Eye Hospital there. Their diet was of the poorest kind, devoid of eggs or milk or its products or meat, except a small quantity of mutton occasionally, once or twice a week, the only redeeming feature of diet being that the rice that was used was the parboiled hand-pounded variety from their own paddy fields and not the milled rice that is largely used in the Delta-areas of Tanjore and the neighbouring districts of Trichy and Cuddalore. The author has made a note of these observations in his "Ophthalmic Surgery and Sight Testing" published in 1926, and pointed this out to Dr. Aykroid when the latter visited the Calicut District Hospital on the 30th March 1936. Dr. Aykroid, however, made the observation that the inflammatory condition of the mucous membranes of the eye, the mouth and the throat was possibly the result of vit. B deficiency also as the condition improves, he said, by the internal administration of brewer's yeast, which is rich in vit. B. It must be added here that most of these cases had some sort of chronic dry itch—another sign of malnutrition commonly met with among the famine-stricken people of the Ceded districts. This, however, confirmed our theory regarding this form of eye disease, that it is a form of deficiency disease with lowered power of resistance to infection. In fact, almost all those cases referred to above fell an easy prey to the Pandemic of post-war type of Influenza of 1918 having suffered in the last stages from acute affection of the kidneys with complete stoppage of urine and Uraemic coma, and terminal Broncho-pneumonia.

(4) Regarding the anti-infective power of vit. A, we have the following observation of Sir Robert McCarrison, "Fertility, the course of pregnancy, of labour, resistence to infection following labour and lactation, are all adversely affected by defect in the quality of food; still births and maternal mortality are also some of the results of defective dietary.

We might well accept this guidance readily with regard to our women and urge insistently that the mothers of our race be fed with knowledge and understanding."

Following these observations of McCarrison, two lady-Doctors of Bombay, (Dr. Balfour and Dr. Talpade) studied the question as to what influence diet exerts on pregnancy and early infant mortality in India, and they have come to the conclusion that the rather unsatisfactory condition of infants was primarily due to protein and Vit. B deficiency in the diet of the pregnant mothers. Drs. Laxmansami Mudaliar and Krishnan of Madras have shown that deficiency of vit. A and possibly of vit. D plays a great role in the production of puerperal infection and predisposes to the condition as vit. A deficiency usually does in all cases of general infections. They are also of opinion that the treatment of the septic conditions after child-birth is greatly benefited by the free use of cod liver oil or its preparations and substances rich in vit. A and vit. D.

(5) Observations from Uganda, China and Ceylon relate a kind of skin disease -Toad-skin, in the Cingalese language—due to deficiency of vit. A (Mac Kay).

2. **Vitamin** B_1—(Anti-neuritic or Anti-Beriberi factor or Aneurin). Vit. B_1 is present in plant seeds, nuts and fruits, eggs and yeast, its richest store being the embryos of grains especially wheat and rice.

"Beemax" (maximum vit. B complex i. e. B_1 and B_2,—containing food) is only ground whole wheat retaining all the vitamins and salts of wheat. In grains vit. B_1 occurs solely in husks as the thin film or silver-skin just covering the grain, wherein also lies the embryo; so that if the husk is polished off as often occurs during the preparation of rice, the grain becomes useless as a source of this vitamin. Soya beans, oats, lentils and grams and millets contain a lot of this vitamin, and certain vegetables like cabbages, cauliflower, amaranth, lettuce, spinach, gourds, pink beans, turnip, ladies-fingers and almost all roots and tubers except colocasia; sweet potato and elephant yams contain a fair amount; ground nuts, almonds, walnuts and jack seeds do also contain a fair proportion. Dried fruits like dates and raisins and fresh fruits such as apples, bananas, grape fruits, oranges, pears, plums and ripe tomatos, beef, sheep's liver, mutton, pork and prawns do contain in varying proportions. Milk is not quite devoid of vit. B_1;

but contains only a trace. Although milk does not contain much of vit. B_1 the buttermilk prepared by fermenting milk as is commonly done in Indian households comes to contain it in an appreciable quantity; it is evidently more stabilised by the ferment used.

Vit. B, (B_1 and B_2) is not destroyed by either drying or cooking at ordinary temperatures.

When vit. B_1 is omitted from the diet it produces in animals a condition of polyneuritis, in which there is pain and muscular weakness leading to paralysis mainly of the hind limbs and often associated with dropsy and signs of extreme weakness of the Heart. In the human being a similar condition, Beriberi, results from the with holding of vit. B_1 from the diet. Now Beriberi is also a form of multiple neuritis and is accompanied generally by dropsy and cardiac disturbances and is most prevalent in places where over-milled rice forms the staple-diet.

Beriberi is very common in the East and has been known to the Chinese and the Japanese for many Centuries, and the first Western Physicians who recognised the disease were the Dutch Doctors who encountered it in their early voyages to the Far East. In Japan the disease has long been termed 'Kakke' meaning "heavy limbs or weak limbs." One form of Beri-beri associated with dropsy is known as "wet beri-beri" and was once named "Epidemic dropsy" as if this were a separate condition.

Beriberi is common in Bengal and is endemic in certain parts of the Northern Circars of the Madras Presidency. The author has seen several cases occurring in an epidemic form among the medical students in Vizagapatam in 1910 soon after the soil was disturbed for the construction of a hostel for them and this corresponded with the onset of the rains also. Evidently the wet-weather and the soil-effluvia lowered the general vitality of the students and predisposed them to the attack of Beriberi, as the rice also they consumed was the highly milled white rice devoid of vit. B_1. This defect, however of the rice was detected for the first time by the late Dr. M. L. Kamath, who was carrying on investigations into the causation of Beri-beri at the time and who later submitted a Thesis which obtained for him the M. D. degree of the Madras University.

The anti-beriberi vitamin is a nitrogenous substance not containing Phosphorus and can be largely furnished by supplying pure dry yeast, malt extract, rice polishings or their alcoholic extract known as Tiki-tiki in Japan, where we said, Beriberi is practically endemic. To the Hospital patients both in Vizag and later in Guntur, the author used to allow 6 ounces of Toddy a day (containing a fair amount of yeast in it), green vegetables especially okra (Bendikai) steamed to retain the salts and salted, and staple diet of parboiled handpounded rice. Recovery usually followed within about 6 to 8 weeks.

3. **Vitamin** B_2 — (vit. G, Pellagra-Preventing factor—shortly termed P. P.)

This vit. B_2 occurs in nature usually in association with vit. B_1 in yeast, meat especially liver, milk and eggs, legumes, fruits, tomatos, vegetables and whole grains.

Deficiency in vit. B_2 gives rise to a disease called Pellagra (=rough skin) which is characterised by certain skin lesions, soreness of mouth and intestinal and nervous disorders. There is anaemia with emaciation. Although it is now recognised that the disease is a deficiency disease it is still possible that mouldy maize may be a causative factor, as a few cases noticed by Dr. Raman in Guntur in 1932 were traceable mostly to mouldy maize, and maize forms the staple food of the poorer people in Guntur and the adjoining districts. The disease is curable by supplying the deficient vit. B_2 through yeast, butter-milk, liver-meat, or its extract by the mouth or by injection into the body.

A common disease of children traced to vit. B (complex) deficiency is the infantile biliary cirrhosis. This disease is curable in the early stage by supplying yeast, fresh milk, fruit juice and Cod liver oil, as the deficiency of vit. B complex is often associated with vit. A deficiency also and deficiency in Ca and P assimilation.

Prevention of some of the vit-deficiency diseases can be easily effected if people make their minds to produce as much of their own food supply as possible; many are able to keep a cow or raise poultry, while nearly all can have a small kitchen garden which will supply them with the necessary vegetables and of

variety. There is no reason to recommend the discontinuance of a particular food unless it is necessary to make room for food of higher "protective" value; instead, the effort should be directed towards adding to the diet to increase variety, in other words to supplement rather than replace the food one is accustomed to.

4. **Vitamin C**—(Antiscorbutic or scurvy preventing factor) Vit. C is present in fresh fruits and vegetables particularly cashew, oranges, limes, lemons, tomatos, spinach, onions, Paprika—in fact all fruits, leafy parts of plants and all root vegetables—potatoes, carrots etc. contain it more or less. Germinated grains are rich in vit. C. The antiscorbutic value of meat is low; yet indeed it must be the raw frozen and often putrid meat which preserves the Eskimo from scurvy (he being so named as he does not cook his food) for, when he adopts European food and method of cooking scurvy takes its toll of him.

(Dr. K. M. Shenai of Mangalore has found out that cashew contains nearly four times the amount of vit. C as is contained in oranges. Paprika, a variety of cayenne pepper also contains 4 times vit. C as is contained in lemons).

The antiscorbutic value of milk depends to a large extent on the fodder of the animal yielding the milk.

The diet of nursing mothers requires a generous supply of this vitamin also.

Vit. C is easily destroyed by drying or canning. Cooking vegetables especially in the presence of alkalies destroys it; nonetheless it is probable that where the potato is the staple diet as in Ireland, it is the main source of vit, C for working class families, and it will be realised that the great Potato famine in Ireland was immediately followed by an out-break of scurvy.

Even Pasteurisation of milk requiring much lesser temperature than boiling destroys vit. C, and it is for this reason orange juice or tomato juice or other antiscorbutics are given to children fed entirely on pasteurised Cow's milk.

The vit. C contained in curds or butter milk is not destroyed by boiling, the presence of lactic acid evidently saves it from destruction.

It is now generally agreed that **scurvy** is produced from

lack of vit. C from food. The disease was described occurring in the Army of Crusaders as far back as 1218 and probably existed long before and has occurred in armies and navies ever since There is no record of the prevalence of the disease among the early mariners, evidently their voyages were too short; but when long voyages became more common scurvy became more common among the shipmen as a result of long abstinence from fresh or green vegetables or fruits.

Vasco de Gama in his trip of doubling the Cape of Good Hope about 1496 lost many men from scurvy.

The first important study of scurvy was the work of James Lind in 1757, and we read Capt. Cook was the first to observe in 1776 that the addition of fresh green food to the diet of the seamen prevented and cured scurvy, and Lind pointed out that scurvy was easily prevented and cured by citrus fruits; his work led to the adoption in 1795 of lemon juice as a compulsory item in the daily diet of the British Naval Vessels—a procedure which resulted in the disappearance of scurvy from the British Navy.

Scurvy is characterised by sponginess and bleeding of the gums, extreme lassitude, formation of haemorrhagic swellings in the thighs and about the eyes and tendency of bones to fracture readily. One important point to remember is that people suffering from scurvy are bad bleeders.

Scurvy is uncommon nowadays in civil life among adults, but common enough among children fed on tinned foods. We have seen several cases of scurvy in Tanjore, all of them in children brought to the Eye Hospital for "Black Eyes" mistaking the condition for some eye complaint; their history revealed that they were all orphans having lost their mothers early and had to be fed on artificial tinned foods.

The essential in the dietetic treatment of scurvy is to supply enough of antiscorbutic vit. C in the shape of fresh fruits and limejuice lemonade. Preserved vegetables have a feebler antiscorbutic value. If fresh vegetables cannot be obtained sprouted grains are equally useful and more nutritious; tomato or potato-juice, oranges, apples, bananas are highly useful. It is a very good rule that infants should begin to receive orange

juice or tomato-juice in addition to their milk even after the first month of life, whether the milk is derived from the mother or the cow, and no artificial foods are recommended for fear of scurvy in children unless supplemented with enough of fresh fruit-juice or tomato juice; malt is a nice anti-scorbutic and is a fattening food for children.

[Prof. Albert Szent-Gyorgyi, noted biochemist of Francis Joseph University, Szeged, Hungary was the first to obtain vit. C or ascorbutic acid as it is known chemically, in crystalline form. For his discovery of the biological processes of oxidation with special regard to vit. C he was awarded the Nobel Prize for 1937.

Only in 1938 he reported the discovery of a new vitamin, christened with the letter P, which is closely related to vit. C and like it is found in lemon and paprika. Paprika is a variety of capsicum (capsicum annum) grown all over Europe. It contains about 4 to 5 times as much of vit. C as lemon.

Dr. K. M. Shenai has been corresponding with Prof. Szent-Gyorgyi regarding his discovery of vit. C in cashew fruits and the Author was shown by him a letter received from the Professor about 20—8—38 in answer to a query from Dr. Shenai as to the nature of paprika].

Deficiency of vit. C in diet has also been known to produce some form of infantile cataract.

5. **Vitamin D.** (Antirachitic or Rickets-preventing factor). Vit. D is generally present in association with vit. A in Cod Liver Oil, butter, yolk of Egg, whole milk, green vegetables and Liver of animals and birds. **Fish Liver oils are the richest natural sources of vit. D.** It has been already mentioned while discussing the importance of vitamins in general that the absorption of Ca and P salts from the food is dependent to a large extent on the presence of vit. D in the food. Hence, deficiency of this vit. in diet interferes with the absorption of Ca and P salts required for growth of bones and teeth, and the bones consequently become soft and deformed as growth proceeds. This condition is rickets and vit. D is, therefore, called the antirachitic factor.

Now, it has been proved that one of the parent substance

of vit. D is a substance called ergosterol, (a form of natural alcohol formed in plants), which acquires on exposure to the Sun's rays antirachitic properties. There is, thus, an intimate relation between vit. D and sunlight; in fact, vit. D is said to be generated by the action of ultraviolet rays on ergosterol. It naturally follows, therefore, that the disease (rickets) should be absent or be rare in places where there is enough of ultra-violet irradiation and it has been found by experience to be so; and infants receiving abundant exposure to sunlight as a rule do not have rickets. Hence it is rare in the Tropics. It is rare also in the Arctic Zone, inspite of the mildness of the sunlight, due to the fact that the diet of the inhabitants of these regions consists largely of fish and fishoils, which we mentioned above are the richest natural sources of vit. D.

The dark skinned races appear to be more susceptible to rickets probably due to the pigment of their skin preventing the beneficial effects of the Sun's rays.

Rickets generally occurs in children within the first two years; sweating about the head, irritability of temper, muscular weakness; delayed teething are the early signs that attract the mother's attention. In the advanced state the "Rickety-rosary" formed by the enlarged epiphyses of the ribs on either side of the breast-plate is characteristic. The bones of the wrists and the ankles become thickened, the shafts of long bones become soft and bend causing varying degrees of deformity depending on the amount of pressure they undergo.

Prevention of Rickets. A proper intake of Ca and P salts with vit. D is needed to prevent rickets. The Ca and P can be assured by an adequate supply of milk and vit. D by supply of Cod liver oil or other fish-oils of proved antirachitic value; yolk of eggs may be added to the infant's diet even at an early age. If sunlight is available—and it is abundant in our climate—sunbaths are recommended provided it is begun with a few minutes of exposure and gradually increased.

The use of milk from especially fed cattle seems to offer great possibilities in the prevention of rickets.

6. **Vitamin E.** (Antisterility-factor). This is present in

vegetable oils particularly wheat-germ oil, embryos of cereals (Beemax) the green leaves of plants, eggs, corns, peas and whole milk. The absence of this vitamin from diet leads to sexual sterility.

(There is little evidence that there is deficiency of this vit. in human diet or indeed that the results apply at all to human beings—witness the fertility of the very poor who obtain very little vit. E in their food; none the less claims have been made that vit E is of value in habitual abortions.

* * * * *

Before we leave the subject of vitamins it would be well to sum up here the matter from the practical stand point. There is no question that our present day dietary is on the whole deficient in the matter of "protective" foods, such as vit. and mineral salts. Fortunately in nature, we have seen, whatever foodstuffs supply vitamins do also supply the essential mineral salts. When appraising, therefore, the physiological value of a diet it is not necessary to scrutinise it carefully for the presence of this or that vitamin and of this or that mineral salt, but it is sufficient to see that our daily menu includes such substances as (1) milk or its products—butter milk etc., (2) Fresh vegetables and fruits, (3) Eggs, liver and fish, and if this is done the essential needs will be covered and as far as protective foods are concerned the diet may be termed "physiologically sound."

G. Accessory Food Factors

In addition to the various food elements including vitamins and salts and water, which are absolutely essential for healthy nutrition numerous other substances, which we call "food accessories," have come to be utilised in the dietary of civilised nations; they are not absolutely needed for nutrition but their use is only to give attractiveness to the food, make it appetising by increasing the flow of saliva and the gastric juice. They are classed under spices and condiments used in the culinary art and are contained in certain oils that give pleasing odours and taste for food and include things like pepper, mustard, salt, asafetida, coriander etc.

Stimulants like tea, coffee, cocoa and alcohol are mostly used for purpose of stimulation and pleasure, and with the exception of cocoa and alcohol they have no nutritional value whatsoever except through the small quantity of milk and sugar added. [Cocoa used in the preparation of chocolate is derived from Theobroma Cacao and has nothing to do with coconut; cocoa contains a small quantity of fats, proteins and Carbohydrates, the active stimulating principle being "theobromine"—allied to caffiene of coffee and thiene of coffee and tea. In the quantity usually consumed cocoa, coffee or tea has no energy value either.

H. Acid-base Foods

The body is an acid-producing organism and there is a constant demand for basic substances for the purpose of neutralisation and excretion of acids; the mild alkaline reaction of the blood should be maintained, the activity of the excretory organs result in a small but constant loss of basic elements. To meet this drain the body draws on the "alkaline reserve" of the tissues. As the store of basic material is **not unlimited** it should be made good by food alone. Hence it is necessary for us to balance or neutralise the effects of acid-forming foods taken in. Acid-forming foods are:

Eggs, meat, fish especially oysters, and poultry; bread (white and brown) cereals, pastries and puddings.

Base-forming foods are:

Milk, nuts, fruits (except prunes, plums and rhubarb) and vegetables especially beans and white potatoes.

II. Food Requirements of Normal Individuals

We saw that the food requirements of an individual are determined by the cell needs of the body for materials of growth, repair and also the production of heat and potential energy. In order that these demands be adequately met the body must be furnished with the necessary quality and necessary quantity of all the essential elements of food above-mentioned, viz. Proteins, Fats, Carbohydrates, mineral salts, Vitamins and Water. Of equal importance is the consideration that these food stuffs be so presented as to be acceptable to the body cells; in other words, they must be such as are easily digested and easily assimilated, that is, more or less completely absorbed into the blood. Now there are many substances like saw-dust, agar and hoof parings for example, which can be analysed into the various food elements and having the physical properties of producing heat, but these are of no use to the system, as they are not only indigestible but cannot be absorbed either and so they are of no value whatever to the system.

It must be remembered that the satisfaction of the cell demands is conditioned also by other factors than digestibility and assimilability, and that is the relationship of the nervous and mental mechanism, such as emotions, sorrow, excitement—these latter being to a large extent dependent on the action of the endocrine secretions; and it will shortly be seen that the rate and intensity of tissue activities also is influenced by these.

A. The Quantity of Food

As one great Authority aptly said, like all other branches of Science, Medical science is in no way immune to the caprice of Fashion and specially so is the science of Dietetics; and a good

deal of work has been done by scientists from time to time to determine the optimum quantity of the three principal elements of diet—the Proteins, the Fats and the Carbohydrates required by man for maintenance of health and efficiency. No definite agreement has yet been reached, which may be applicable to the human race as a whole. One of the resons for this diversity of opinion seems to be that the human body can adapt itself to all forms of environmental changes including the matter of Diet.

The quantity of food required by the body depends upon several factors:

1. **Age** is an important modifying factor; in the span of life from birth to maturity age is the greatest single factor modifying the energy needs of the body; in children as will be seen later, the tissue activities are relatively higher than in the adults, hence additional allowance should be made for this and for growth also.

In adults the total energy requirement is determined by the size of the body and muscular activity as work, and after about the 40th year when the metabolic needs are decreasing the amount of food is also correspondingly less; but with **advancing** age the lessened functional activity of the organs and the tissues make it necessary to adopt a suitable dietary to the energy requirements.

. The danger of over feeding in the old is almost as great as the danger of under-feeding in the young; age cannot be defied and one cannot with impunity continue to do the same things in the matter of diet any more than in anything else.

Fat and obese people are naturally weaker and have lesser power of resistence to disease than people of muscular build; there is, thus, an intimate relation between Life Insurance-mortality and overweight of the body from fat. Leanness and longevity, they say, go together, and "a man will only roll all the faster down the hill of life if his figure be **rotund.**"

In women the difference in the rate of tissue-activities (metabolism) is due mainly to the larger proportion of fat than muscular tissue and also the amount of energy output.

It will be shown later that women during pregnancy and

lactation do require more food and of an easily digestible and better quality containing fats, vitamins and salts of Fe and Ca.

2. **Activity.** The degree of **activity** is by far the most important factor in determining the food requirements above that necessary for mere sustenance. Lowered levels of nutrition and susceptibility to certain forms of disease are entirely due to failure of properly adjusting the quantity of food-intake to the needs of muscular activity and work.

This adjustment of the quantity of food to the amount of work done is important **at all age levels,** particularly for middle aged persons leading a sedentary life after a strenuous one during adolescence or adult age.

3. **Climatic Conditions.** In a cold climate man is naturally capable of more work than in a warm climate. Food requirements are, therefore, greater in cold climates than in hot. People of cold countries require more fats to produce greater amount of body-heat than those of warmer countries; of course carbohydrates would equally serve this purpose, but carbohydrates are only less than half as useful as fats; moreover in very cold climates carbohydrates are not so easily obtained as fats. This is the explanation of the enormous amount of blubber fat, which the Eskimo consumes, sometimes as much as 20 lbs. a day; a similar adaptation to circumstances on the part of Nature is seen in the milk of the walrus, which contains as much as 40 p. c. of fat (while ordinary cow's milk does not contain more than 3.5 or 4 p. c. of fat), the object of nature in these cases being to supply the young animal with an abundant and compact source of fuel and enable it to maintain the body temperature in the icy-waters of the Arctic regions. The milk of some kinds of mammalian Whales is said to contain about 43 p. c. of fat.

Even in our own Country those living in the Northern parts require more food than those in the South, nearer the Equator.

1. **Quantity-requirements of Proteins.** As protein forms the essential part of the body cells and is present in large amount in muscles and in relatively small in bone and fatty tissue it is clear that the supply of proteins should be adequate for building new tissue during growth, pregnancy and lactation, convales-

cence from severe illness and in muscle-building or athletics-training, and provision should be made for tissue "wear and tear" of life processes. Proteins are, therefore, the most indispensable constituent of diet and without protein life is impossible.

Using the customary ration of an average labourer as a basis, Carl Voit on observations on German-labourers considered about 4 oz. of proteins per day a satisfactory amount; while Chittenden in America by studies on himself and a large group of students and soldiers fixed about 1½ oz. as the optimum quantity. He thinks that indulgence in larger quantity of proteins imposes a needless strain on the Liver, the Kidneys and other organs involved in the metabolism and elimination of the end-products. Mc. Cay discussing the correlation of Protein-intake with health and vigour and material progress of certain tribes in India does not agree with Chittenden and favours a definitely higher concentration of proteins in the diet. Bogert sums up the question when she says "the best concensus of scientific medical opinion now seems to have settled upon an intermediate view, viz., that there are certain dangers inherent in taking either a very high or a very low protein diet over long periods and that the inclusion of a moderately liberal amount of proteins in the diet is a factor of safety, to give the maximum growth and sustained vigour."

A safe range would. therefore, seem to be that advocated by Mc. Carrison, which is 90 to 100 grammes (3 to 3½ oz.) per day.

2. **Quantity requirements of Carbohydrates.** Carbohydrates are the most abundant and cheap source of energy. They are classed under sugars and starches. Although they cannot be stored in any great quantity by the body they can be transformed into fats and be held in reserve. About 350 to 450 grammes (10 to 15 oz) is said to be the average daily requirements of an adult male using about 2500 calories, (which, see later) and it is sound practice to secure most of these Carbohydrates from cereals, fruits and vegetables. Sugar by itself is irritating to the system and must be minimised in the diet. Jaggery prepared from date palm, palmyra or cane juice is a much better substitute

for refined sugar, containing as it does more nutriment and larger percentage of Ca and Fe salts and vitamins; jaggery is cheaper also; in the case of sugar, therefore, one has to pay much higher price to a really lesser quality of food article.

3. **Fat Requirements.** All fats, we have seen, are valuable as concentrated fuel, and animal fats especially are bearers of vit. A and D. They are used for their flavour and satiety-value. People in colder climates require more fats for obvious reasons.

For all practical purposes about 80—90 grammes (2½-3 oz.) of fats may be said to be the adequate daily requirements provided the fat is in a digestible and assimilable form. Animal fats have already been shown to be superior in all respects including the presence of vit. A and some of them vit. D also, to vegetable fats and to be more easily and completely digestible. Vegetable fats are as a rule lacking in vit. A, (except the red palm oil already mentioned) and are more difficult of digestion; hence the use of butter and its substitutes, plenty of milk, green vegetables and eggs are recommended to supply the needed quantity of fats and incidentally vitamins also.

4. **Inorganic Salts.** We repeat here that Ca and P are present in large quantity in milk and milk products, eggs, beans, unhusked cereals and greens (amaranthus); that whole cereals, nuts and glandular meat of animals (like the liver and the kidneys) are direct source of P. Iron occurs in green leafy vegetables, egg yolk, meat and whole grains in large quantity. Iodine should be obtainable from sea-salt in preference to rocksalt.

5. **Water Requirements.** Water, we have seen, forms the structural element of Protoplasm and a large percentage of our body; it forms a vehicle of transport and solvent and regulator of body temperature; and it has been shown any considerable decrease in the normal amount of water in the body interferes with its manifold activities, which are essential to the highest levels of health; moreover the quantity of water lost through the Kidneys, Lungs and the Skin is enormous and should be immediately replaced by water either taken as drink,

beverages and soup or that contained in the solid foods. This intake should be specially large in the Tropics for reasons already mentioned. "The taking of 6 or 8 glassfuls of liquid daily will assure a satisfactory water equilibrium if the dietary intake is 'well-balanced." Lack of sufficient fluid is one of the chief causes of the widespread constipation encountered in Tropical practice.

Water, however, should not be taken in large quantity with meals, as in that case there is a natural tendency to minimise mastication of food in the mouth, which is highly essential for the proper admixture of saliva (insalivation of food) necessary to digest part of the starch of the food into sugar by the action of ptyalin ferment contained in the saliva; large quantity of water dilutes the digestive juices also and hence retards digestion on the whole. There is one important physiological principle to be mentioned in this connection, viz., the time required for the stay of food in the stomach, before it passes on to the duodenum, is greatly reduced by an exceedingly fluid-state of the stomach contents (the chyme), thus very little time is given also for absorption of peptones (the products of digestion of proteins) large part of which may thus be lost to the system.

Water is best taken the first thing in the morning or half to one hour before meals; when the stomach is empty water tends to wash out the mucus or remnants of food or impurities that may be left in the stomach or the bowels. No other drink is needed as a rule and no other ought to be permitted; in fact drinks like coffee or tea are unnecessary stimulants and their chief value lies in the water these drinks contain and their stimulation is "a delusion, a pit-fall and a snare." A free action of the bowels which follows soon after taking coffee or drink in some people habitually constipated is explained in this way.

6. **Roughage Requirements.** It has been mentioned above that roughage is a necessary stimulant of the bowels for their daily action and that the necessary bulk could be supplied by cellulose derived from green vegetables and fruits. Fruits and greens do contain organic acids—malic, citric, tartaric and oxalic acids—whose salts have an aperient action on the bowels, while cellulose can be said to be a mechanical stimulant to

peristalsis; fruits and greens act by their chemical action. Vegetable acids have one more use to the system, viz., by forming neutral carbonates they serve to preserve the alkalinity of the blood and other body fluids.

7. **Vitamin Requirements.** Although, as shown already, vitamins are essential for the prevention of certain well defined diseases, they are not a cure-all for nutritional disturbances, even though they do play an important role in all sound dietary. They have already been shown to be essential in promoting health and increasing the power of the body to resist disease.

The exact amount of vitamins necessary for optimum health is a matter difficult of calculation, but there is no doubt that an adequate amount of cereals, milk and its products, animal fats, fruits and vegetables in a diet does contain them in an **ample measure.**

Satiety Value of Foods. Man eats largely to secure the feeling of satisfaction and wellbeing resulting from eating, in fact he thinks little about the nutritive value of his food unless compelled to by disease. This feeling of satisfaction is induced and modified mainly by the length of time the food remains in the stomach.

Now, fat leaves the stomach more slowly and the emptying time is delayed by a meal containing fat and meats, and if at the end of the meal something sweet is taken the satiety value becomes still greater. This is only common experience. The physical character of the fat has an influence on the digestibility; emulsified fat of milk (butter) is easily digested, while melted fat or heated fat used in cooking is not only by itself slow to digest but exerts a retarding action on the material cooked in it. This is due to the fact that the secretion of the gastric juice is restrained by fat, and that articles cooked in fat are rendered impermeable so to say, to the digestive juices.

Fats and sugars and fruits taken as desserts also have a great satiety value; but it is only the richer classes that can afford such foods as they are comparatively expensive. The poorer classes have to resort to inexpensive foods like topioca, ragi, pulses, grains and cheap fruits such as jack fruits and seeds,

papaya, plantains etc. It should not be understood that these satietary foods taken by the poor are devoid of any real nutriment, on the other hand, some of them are very nutritious especially ragi, grains, papaya and plantains; and raw cocoanuts and jack seeds, which are often taken as food by the poorer classes have of late been proved to be fruitful sources of nutriment and vit. B_1 and B_2.

The feeling of satisfaction from any foodstuff depends, we mentioned, on the sense of fulness and the time taken by the food to stay in the stomach.

B. Food Energy and Vital Energy

The body is frequently compared to a Heat Engine and in so far as the oxidation of the energy-yielding material and the production of mechanical energy and heat are concerned the analogy is an apt one; but there is, however, a most important difference between the inanimate heat-engine and the living-body mechanism, viz., when the inanimate engine ceases to work it cools down and remains in that state unless started to work again, and it is at this point that the analogy between the living body and the mechanical engine breaks down; for the living mechanism is constantly producing heat and enough of it to maintain the body temperature against constant tendency to lose heat. It is obvious that this heat production must continue even in the absence of readily available supply of energy material that is, even during starvation.

Briefly, then, for the bare maintenance of the living condition, apart from any voluntary muscular movements or mental activity, there is required **a definite minimum heat-production**; this is known as the Basal Metabolism or Basal Metabolic Rate, which is written as B. M. R.

Now the origin of the heat which constitutes B. M. R. is this: If the vital equilibrium is to be maintained certain vital organs like the heart and the lungs, the organs of digestion, liver, kidneys and the glands must continue the characteristic activity even when the voluntary or the skeletal muscles are at comparative rest; infact, the B. M. R. represents the **minimum**

heat production of the body at the time of complete muscular and mental rest 14 to 18 hours after the last meal.

During sleep, therefore, the B. M. R. is at its lowest.

Now, the B. M. R. is influenced by certain other conditions than sleep, such as age, sex, state of nutrition, presence of disease, external temperature and the extent of surface-area of the body. Now the larger the surface area of the body the larger is the amount of heat lost from the body by evaporation or conduction or radiation; on a hot day, therefore, the B. M. R. should necessarily be less than on a cool day, and that explains the enervation and lassitude of the summer heat.

The B. M. R. has been estimated at about 1800 calories a day in male adults and 10 p. c. less or about 1740 calories in female adults; and as the surface-area in children is much less than in adults the B. M. R. in growing **children** should necessarily be **relatively higher** than in adults.

The B. M. R. depends upon also the state of nutrition of the subject and the reduction of the body weight to 10 to 15 p. c below normal by restriction of the food-intake results in very considerable reduction in the B. M. R.

Temperature. It is common experience that when the external temperature is low there is an increased muscular tone until spasmodic muscular contractions, which we call shivering, occur, and muscular activity inevitably causes increase in heat production. In certain fevers the B. M. R. is immensely increased depending upon the temperature, but while sweating profusely it is lowered correspondingly.

In diabetes the B. M. R. is increased as a rule, unless the patient is definitely undernourished, in which case it (B. M. R.) is much below par and can be increased by the administration of Insulin, the hormone of the pancreas, which has the power to increase the B. M. R. Thyroid extract increases heat production and is generally given to immature babies.

Calorimetry.

Since energy can be expressed in various terms and since the fuel value of food is determined by measuring the quantity of

heat produced when a known weight of a foodstuff is burned (in a calorimeter) it has been customary to express all energy values connected with nutrition in term of "calories." A calorie is the unit of quantity of heat required to raise the temperature of 1 Kilogramme (2.2 lbs) of water by 1° Centigrade.

Now, the B. M. R. represents only a portion of the total energy-transformations taking place in the body while practically at complete rest; and the most important element increasing the energy metabolism is muscular work. It has been estimated that about **100 calories per hour** are produced by a man sitting **still**; the same man **working** will produce 300 calories per hour; mental or nervous activity also increases metabolism but only to a very slight extent as even the total weight of the entire nervous system forms less than 2 p. c. of the entire body weight.

The caloric values of food-elements like Proteins, Fats and Carbohydrates have been estimated; but they do not necessarily represent the amount of nett-energy, that is actually yeilded in the body. Making an allowance of 2 to 5 p. c. for the loss during digestion etc. Rubner gives the following energy-values, and his figures are usually employed in calculating the "fuel" values of food ingredients. They are;

Carbohydrates	...4	calories per	gramme
Fats ...	9	,,	,,
Proteins	4	,,	,,

It is clear from the above that from a purely energy aspect Carbohydrates and Proteins are of equal value and that Fat yeilds more than twice as much heat as either Carbohydrate or Protein.

Now, nearly all our foodstuffs contain these three elements (Fats, Carbohydrates and Proteins) though in different quantity and proportions; and by analysis it is possible to say how much of each of the ingredients are contained in a particular foodstuff. It is then possible to calculate the actual energy value in calories of that foodstuff.

According to McCarrison one ounce of the best unpolished rice contains:

2.3 grammes of Proteins.
22.3 grammes of Carbohydrates
and 0.085 grammes of Fats.

The total caloric-value, therefore, of one ounce of unpolished rice is obtained as follows:—

Proteins	2.3 grammes	×4	(Rubner's figure)	= 9.2 Calories
Carbohydrates	22.3 ,,	× 4	,,	= 89.2 ,,
Fats	0.085 ,,	× 9	,,	= .765 ,,
			Total	99.1 ,,

Hence, the total caloric-value of one ounce of unpolished rice is just over **99 Calories.** Similarly we find that the energy value of one ounce of milk is about 18 calories, and of one ounce of mutton 42 calories.

C. Caloric Requirements of Energy

The Reports on the Physiological bases of nutrition drawn up by the Technical Commission of the Health Committee of the League of Nations which met in London in Nov. 1935 was published at Geneva on 6th Dec. 1935. It lays down as follows:

''An adult male or female living an ordinary everyday life in a temperate climate and not engaged in manual work is taken as the basis on which the needs of the other age-groups are reckoned. An allowance of 2400 calories **net per day** is considered adequate to meet the requirements of such an individual and the following supplement for muscular activity should be made to the basic-requirements.

Light work	—up to 50	calories	**per**	**hour of**	**work.**
Moderate work—	,, 50 to 100	,,	,,	,,	
Hard work —	,, 100 to 200	,,	,,	,,	
Very hard work—	,, 200 and more	,,	,,	,,	

The energy requirements of other ages vary from 720 to 2160 calories in the case of children from 1 to 12 years of age; and after the 12th year the basic requirements are the same as for adults. In the case of pregnant women the requisite calories are fixed at 2400, and in the case of nursing mothers at 3000.

In the case of babies under 1 year the basic requirements

are difficult to specify; but an allowance of 100 calories per kilo (= 2.2 lbs.) of body weight is considered adequate.

The muscular activities characteristic of every healthy child and adolescent necessitate additions to the basic requirements. It is suggested that the activities of children of both sexes from 7 to 11 years of age be considered equivalent to **Light** work, of boys from 11 to 15 years as **Moderate** work and of girls from 11 to 15 years as **Light** work. Allowance should also be made for women engaged in household duties whether pregnant or not; these have to be reckoned as equivalent of **Light** work for 8 hours daily."

Mc. Carrison fixes it at 2500 to 3500 calories for an Indian in prime of life according to the part of India in which he lives and the work he has to do. He also fixes the total **daily** needs of such an individual at:

Proteins	— 90—100 grammes		(3 —3½ oz.),
Fats	— 80— 90	,,	(2½—3 oz.),
and Carbohyrates	— 360—450	,,	(10—15 oz.);

which should yield a total of the requisite number of calories mentioned above. It works as follows:

Proteins 90—100 grammes ×4
(Rubner's figure) = 360 to 400 calories,
Fats 80—90 grammes ×9
(Rubner's figure) = 720 to 810 calories,
Carbohydrates 360—450 grammes ×4
(Rubner's figure) = 1440 to 1800 calories,

Total 2520 to 3010 calories.

Now, this total energy should be distributed among the three chief types of food-elements in the required proportion as all these elements are needed for the body processes: roughly Proteins: Fat: Carbohydrates = 1: 1: 4. Now, there is no single article of food which contains all the different nutritive constituents in the above mentioned proportions; some foods are too rich in Proteins, others contain too much Carbohydrates or Fats; the former statement is true of all animal foods, and amongst the vegetable foods, of such articles as peas, beans, lentils. Most

other vegetable foods such as potatoes, rice, bread contain an excess of carbohydrates. The practical outcome of this is that a proper diet must be a "mixed one," the excess of one particular element in one article of food balancing the defect of another article; this is true also in respect of the vitamins.

Man has found this by experience and has adopted certain combinations, such as, bread and cheese, beans and bacon, potatoes and beef, the surplus of the carbohydrate and fats in the first article being balanced by the excess of protein in the second. That man is right in doing so is borne out by the disastrous results which have followed attempts to live for any length of time on one single article of food (with the exception of meat in the case of the Eskimo or milk in the case of babies). One observer, Hammond, tried to live himself on a daily ration of a pound and a half of starch along with water. He had to give up the experiment on the 10th day owing to the onset of extreme debility. On a second occasion he tried to live on albumen alone; after the 9th day diarrhoea set in with dropsy and cessation of urine.

The need for a mixed diet. We may now study how it is possible for life to be best sustained through ordinary foodstuffs with the greatest **economy** as regards the work thrown on the various organs concerned, viz. those of digestion and of excretion of waste materials from the body. Physiologists have calculated that the daily loss of Carbon and Nitrogen from the body amounts in the case of an adult doing ordinary work to:

Carbon —280 grammes
Nitrogen— 22 grammes

1. Now let us suppose that a person chooses to live on **meat** alone; we know that one lb. of meat contains 40 grms. of Carbon and 12 grms. of Nitrogen; in order, therefore, to obtain the necessary amount of Carbon (280 grms.) he has to consume not less than 7 lbs. of meat: such a quantity is not only too large to be digested but contains about 84 grms. of Nitrogen, of which (84—22) or 62 grms. is a waste and should throw an extra strain on the excretory organs, the kidneys especially.

2. Next let us suppose a person to feed on Bread alone;

one pound of bread contains 135 grms. of Carbon and 4.5 grms. N.; and in order to obtain the necessary quantity of Nitrogen to replace the daily waste he would have to take about $5\frac{1}{2}$ lbs. of bread; but this weight of bread contains about 720 grms. of Carbon and 22 grms. of Nitrogen—In this case the man would be compelled to take more than double the quantity of Carbon required in order to supply the necessary weight of Nitrogen. This, again, not only throws an extra work on the stomach and kidneys but is a large waste itself economically also.

But it is possible to take such a "mixed" diet of bread and meat as to supply all the necessary amount of C and N and at the same time **without any waste.** In doing this we also reduce the total amount of food taken.

Thus, 2 lbs. Bread (containing 270 grms. C and 9.0 grms. N)
and $\frac{3}{4}$ lbs. meat (,, 30 grms. C and 9.0 grms. N)
would give a total of 300 grms. C and 18 grms N; in other words, by adopting a "mixed" diet we have not only to consume $2\frac{3}{4}$ lbs. of solid food daily but are enabled to make good all the waste of the body taking an excess of 20 grms. of C only. This clearly shows the advantages that may be gained by a mixed diet, which is selected with due regard to the daily requirements of the body. Such a diet, provides against **monotony** also.

Judging from another stand point--caloric stand point—we come practically to the same conclusion. We have seen that one ounce of mutton yields 42 calories; supposing a man living on mutton alone: to obtain 3000 calories daily he will have to consume about 7 to 8 lbs. of mutton daily which is practically the same quantity as we obtained above."

Now, we have already seen that the presence of vitamins is necessary for the proper digestion and utilisation of all the four important constituents of foodstuffs, viz. Proteins, Carbohydrates, Fats and Minerals. This further brings out in prominence the most important characteristic of a mixed diet, viz., (1) that it ensures the presence of vitamins in one or other of the articles of diet, (2) that it is much more easily digested and assimilated than a diet consisting of only one single article of diet, (3) that it provides for variety and (4) that it is highly economical so far as cost and wastage are concerned.

D. Balanced Diet

Having so far studied the principles of dietetics from both qualitative and quantitative aspects of the essential elements of a perfect diet, we are now enabled to lay down the principles governing the constituents of an adequate diet or rectify the defects of that in common usage. These principles, whether in health or in disease are the same: calories, proteins, carbohydrates, fats, salts and vitamins are the essentials and should be presented in proper form. They should be derived preferably from both animal and vegetable sources; milk should form part of the ration for adults as well as for children and especially for nursing mothers. Fresh fruits and leafy vegetables have assumed a new importance; in the light of recent research they should form a fair part of one's diet to provide sufficient ''ballast'' for the bowels The effects of cooking and canning or otherwise preserving food, on vitamins make it advisable further to use some fruits and vegetables fresh and taken uncooked also in the dietary.

From the point of view of fact as well as of probability it is apparent that nutritional safety is ensured by ''variety'' in the selection of food stuffs In this connection it must be noted that **one unique property of the living organism is that it can adapt itself within a certain range of environmental conditions;** and a change of environment is as is well known ''stimulating'' variety may, therefore, be said to be the keynote of Practical Dietetics, it ensures that nothing is left out, it stimulates the palate and it alters the nutritive medium surrounding the cells.

Mc. Carrison gives the following as an example of a well-balanced diet usually employed by certain wheat-eating races of Northern India and for this reason, he says, ''no races of mankind are better developed physically nor more capable of endurance and hard work.'' It consists of:

12 oz. Atta.
6 oz. Rice (handpounded).
2 oz. Meat (mutton).
20 oz. Milk.

1 oz. Vegetable oil.
1½ oz. Ghee.
8 oz. Root vegetables
8 oz. Cabbage.
4 oz. Mango.
1 oz. Dhall.

and represents

Proteins, 95 grms.
Fats, 86 grms.
and Carbohydrates, 435 grms.
(after allowing 10 p. c. for wastage)
and has a fuel value of 2900 calories.

Common Indian Diets and their Defects
(After McCarrison)

I. Suppose the staple article of diet is **wheat** and that this is eaten in the form of **atta.**

(a) The atta provides enough carbohydrates but not enough of fat. The latter must, therefore, be added. The best way to do this is by taking butter, ghee or mutton-fat with the atta, because these animal fats not only provide the fat required as fuel food but vit. A as well. Vegeteble fats will provide the fat but not enough of vit. A.

(b) The proteins of atta though better than those of most other grains are not good enough nor are there enough of them. So we must select some other food to eat with **atta** which will provide a sufficiency of "suitable protein." For this purpose we can take milk or sourmilk or curds or butter milk or cheese; or we can take meat or poultry or liver or fish or eggs.

If a man eats one pound of atta-chapathis a day, he will get all the suitable proteins he needs by taking with the chapathis plenty of green leafy vegetables and a pint and a half of milk, though he will be a stronger man if he takes 2 pints (one quart) of milk; or by taking green leafy vegetables and a pint of curds, or green leafy vegetables and 4 or 5 ounces of meat, or 2 or 3 eggs.

It is both economical and advantageous that a certain

amount of the proteins added to atta should be provided from vegetable sources such as Dhals.

(c) A third defect of atta is its deficiency in vit A; the best addition to make good this defect is whole milk or its products—butter or ghee; so that by taking milk and butter or ghee with the **atta** we not only provide the "suitable proteins" and fats but the vit A, in which it is deficient: we, thus, make good **three** of the chief defects of the wheat. We can get the vit. A from other sources besides milk, butter or ghee: such as from fish, eggs, liver, kidney and green leafy vegetables. By taking green leafy vegetables and meat, or egg, or liver, or kidney, or fish, with the **atta** we make good two of its chief defects: suitable proteins and vit A. Some of these animal foods – egg, liver and fat-meat – will also make good the deficiency of fats in the atta.

(d) A fourth defect of atta is its deficiency in vit C. So we must select some food or foods which are rich enough in this vitamin to make good this defect. The best foods for this purpose are green leafy vegetables or sprouted grains.

Thus by taking milk, milk products and green leafy vegetables we make good four of the defects of the wheat: fats, suitable proteins, vit A and vit C.

(e) A fifth defect of **atta** is its deficiency in vit D: a foodstuff has, therefore, to be selected to rectify this; and we can choose either milk and its products—butter or ghee—or egg or fish oil for this purpose. Any one of these, or the action of sunlight on the body with an occasional oil bath will provide all the vit D we need.

(f) A sixth defect of atta is its deficiency in certain mineral elements, particularly Ca, sodium and chlorine. They can be best supplied by green leafy vegetables, fruit and milk; and as wheat does not contain much Iron some of the vegetables used should be rich in Iron, such as whole cereals, dhals, spinach, onions, radishes, asparagus, celery, amaranthus, cucumber, tomatoes etc. It is well to combine **atta** with plenty of vegetables and fruits, so that the non-irritating vegetable matter may help the action of the bowels, and the acid-produc-

ing tendency of the **atta** may be counteracted by the alkali-producing tendency of the vegetables and fruits.

We see, therefore, that if whole-wheat flour (atta) be the staple article of diet and we take with it milk, milk products, dhal, green leafy vegetables and fruits with flesh-meat occasionally we get everything the body needs for health, strength and vigour.

Now, this is precisely the kind of food which the wheat eating races of Northern India do eat if they can get it, and for this reason no races of mankind are better developed physically or more capable of endurance and hardwork. But it is only when they actually eat this kind of food and make good each and every one of the defects of the wheat that they remain in good health and vigour even unto old age.

* * * * *

II. Suppose the staple article of diet is **Rice.** The rice may be raw home pounded or polished; or, parboiled hand pounded or polished.

(a) Whatever rice is used it contains enough carbohydrates or fuel food, but its proteins are not only scant in amount but are poor in quality. So this defect should be put right in the same way that it has to be put right for wheat; with these differances, however, that there is twice as much protein in wheat as there is in polished rice and that the proteins of wheat are* **better(?)** than those of rice. So we must make up the quantity of proteins as well as their quality. This we can do by

**This is the opinion of McCarrison, but Prof. Subramanian of the Biochemistry Department of the Indian Institute of Science, Bangalore in the course of an article contributed to the "Hindu" of the 22-3-'38 says: "There is ample experimental evidence to show that rice-protein small as it is in quantity is nutritively superior to that of wheat. It is richer in regard to the essential amino—acids and taken in equal-weight-basis promotes better growth than wheat-protein. Unfortunately the present taste is such that even the small quantity of protein is largely rejected in the form of bran and only the residue is eaten."*

taking 3 or 4 oz. of dhal in addition to the green leafy vegetables, **and** milk or curds or meat or eggs, which we have learnt it is necessary to take with wheat. Infact it has been found that a diet of home pounded rice, dhal, vegetables with a small amount of animal proteins, preferably milk proteins, is almost unassailable from the point of view of modern ideas of nutrition and is further suitable in the tropics.

(b) Rice does not contain enough fats and therefore, the rice diet must be taken with butter, ghee or vegetable oils, the first two being much the best because they contain vit. A, in which rice is very deficient.

(c) The great fault of rice is that it contains so little vit. B; this deficiency being greater when rice is milled and polished or when it is parboiled and much washed. So we must select some food or foods which will provide the vit. B in which rice is lacking. By far the best way to do this is to substitute **atta** (whole wheat-flour) for one quarter to one-half of the rice ordinarily eaten; the atta contains much vit. B and besides this it increases the quantity and quality of the proteins in the food. But many people in the South and East of India cannot get **atta**, so the next best thing to do is to take Dhal with the rice: One part of dhal to every 5 parts of the rice and not more than 4 or 5 oz. of dhal a day. The addition of this amount of dhal to the rice diet increases both the vit. B content of the food and the quality of Protein. So that by adding **atta** or **dhal** and **green vegetables** and **milk** to the rice diet we make good the defect of the rice so far as the quantity and quality of Proteins and so far as the quantity of vit. B are concerned.

The other defects of the rice are the same as those of wheat and must be put right in the same way.

* * * * *

III. Staple article of Diet—**Millet** (ragi, bajra). The defects of this grain are:

(a) it contains more protein than rice but less than wheat, and its proteins, while better than those of rice are not quite so good as those of wheat;

(b) it contains 2 to 3 times as much fat as rice, but not

quite enough to make further addition of fat to the food unnecessary:

(c) as it is eaten after grinding into meal, it contains plenty of vit. B but too little vit. A and no vit. C and D;

(d) it is, like all other cereals poor in certain mineral salts though more deficient in Ca Salts than wheat or whole rice;

(e) it lacks the necessary vegetable residue or ballast to help the action of the bowels.

So in order to make the Ragi diet 'complete,' foods containing suitable proteins must be added to it, while its deficiency in fats, vitamins and mineral salts must be put right in the same way as that of wheat and rice.

* * * * *

IV. The defects of other staple food-grains—such as barley, cambu, cholam etc.—are the same as those of cereals in general, and they can be corrected in the same way as those of wheat, rice or ragi.

Badly Balanced Diets

McCarrison gives the following diets in use by:

(a) a poor Hindu Family,

(b) a well-to-do Hindu Family in Madras,

both of which, he says, are examples of Badly-balanced Diets:—

(a) The Poor Hindu Family Diet

Consists of:

	Polished rice . . .	21.0 oz.
	Dhal	0.7 oz.
	Black gram	0.7 oz.
	Vegetable oil . . .	0.1 oz.
	Vegetables	2 oz.
	Meat or Fish . . .	0.06 oz.
and	Cocoanut	0.05 oz.

This gives after allowing 10 p. c. for waste:

Proteins	42.92	Grammes
Fats	7.18	,,
Carbohydrates ...	520.20	,,

and yields 2325 calories.

Now, this diet contains too little Protein, all of which is of vegetable origin, far too little fat, too much Carbohydrate and not enough Calories; it is dangerously low in all the vitamins especially A and B, and it is deficient in mineral salts notably of Ca, P and Fe.

The family living on this diet, Mc. Carrison says, were of "low vitality incapable of sustaining hard work and prone to bowel complaints."

(b) The well-to-do Hindu Family Diet

Consisting of:

Polished rice	... ...	23.0 ounces
Dhal	... ...	1.2 ,,
Gram	... ...	1.9 ,,
Vegetable oils	... ...	1.2 ,,
Ghee	... ...	0.4 ,,
Curds	... ...	9.0 ,,
Vegetables	... ...	6.0 ,,
Cocoanut	... ...	2.0 ,,
Sugar	... ...	1.0 ,,
Milk	... ...	7.0 ,,

representing after the usual 10% allowance for waste,

Proteins	... ...	75.7 Grammes
Fats	... ...	85.3 ,,
Carbohydrates	...	643.1 ,,

and yielding 3651 calories.

This diet is too poor in animal proteins and animal fat, too rich in Carbohydrates and too high in calories. It should be adjusted by reducing the amount of rice, and substituting unpolished rice and by increasing the amount of milk, milk products, green leafy vegetables and Fruits.

Faulty Nutrition in General

"The Commission is in agreement with the conclusions of the Barnet and Aykroid Report that 'deficiencies in important nutrients are a common feature of modern diets and that these deficiencies usually occur in the protective foods (foods rich in

minerals and vitamins) rather than in the Energy-giving foods," states the latest Report of the Technical Commission of the Health Committee of the League of Nations published in Dec. 1935.

It will be noticed from the Summary of their Report given below, that the Commission's views and recommendations are in the main in full agreement with the basic principles of knowledge already described in these pages but embodies much more especially regarding the requirements of children and adolescents. Briefly they are:

(1) The **protein-intake** should not fall below the prescribed optimum amount and should be derived from a **variety of sources**, and it is desirable that a great part of the proteins should be of animal origin. During growth, pregnancy and lactation some animal protein is essential, and in the growing period it should form a large proportion of the total protein.

2. **Fats** must form a constituent of normal diet, and should be allowed in proper quantity, which may have to be increased in cold climates.

3. **Mineral and Vitamin Requirements**. The Commission recognises the fact, as we saw, that deficiencies of modern diets are usually in the protective foods (foods rich in minerals and vitamins) rather than in more strictly energy-bearing foods (foods rich in calories).

Among the **protective** foods are, first and most important, milk and milk products, Eggs and glandular tissues; then green leafy vegetables, fruits, fat fish and meat (muscle).

4. Among the energy-bearing foods of little or no protective power are sugar, milled-cereals and certain fats; of energy-giving foods milled cereals are not rich in protective nutrients (vitamins and salts) and the more they are refined the less is their protective power. Many fats, especially when refined possess little or no protective constituents.

Refined sugar is of value only as a source of energy as it is entirely devoid of minerals and vitamins. The increasing habit of large sugar consumption tends to lessen the amount of protective foods in the diet and is to be regarded with concern.

5. **Requirements of Pregnancy and Lactation.** The

pregnant and nursing woman should be regarded as a member of the population needing the greatest "protection" in order to ensure an adequate physical endowment for the child at birth and optimum nutrition during infancy. The great difficulty in arranging such a diet is to provide adequate Ca, P, Fe and vit. B_1 vit. B_2, vit. C and vit. D. Milk (whole or skimmed) is a rich source of Ca, P and of vit. B_2, also a good source of vit. B_1; milk fat is an excellent source of vit. A.

Eggs contain vit. A, vit. B_1, vit. B_2 and vit. D and are rich in Fe. The protein of these foods (milk and eggs) are not only themselves of the highest nutritive value but also improve the utilisation of the proteins contained in cereals and vegetables, (what we already mentioned above as "raising the biological value of other foodstuffs"). Milk has an additional advantage in the abundance and the availability of Ca Salts and Phosphates; these salts, we saw, enhance the effect of any vit. D derived from other articles of diet and from sunshine. Milk, although itself poor in Iron renders more effective the iron contained in the other ingredients of diet.

Ordinary diets are usually inadequate in vit. D and except in sunny seasons and sunny regions a small daily ration of Cod Liver Oil is to be recommended in the dietary of the pregnant and nursing mother and in that of the growing child. Fish-liver-oils are the richest known natural sources of vit. A and are also important sources of Iodine; in goitrous regions, where sea-fish are not available the provision of extra Iodine in the form of Iodised salt or in some other way is recommended.

An extended dietary use of Potato is recommended to replace a part of the sugar and highly milled cereals in the ordinary diet. Potatoes provide extra vit. D and more readily available Ca and P than are present in cereals. Potato also yields more Fe and vit. B than milled cereals.

(The above paragraph applies to countries where potatoes are abundant, but it is of general application due account being taken of the local resources).

6. Requirements of other adults and children: For growing children, the Commission recommends, the maintenance

of a high proportion of protective foods should be the aim; since the rate of growth of a child decreases with advancing age approximately the amount of the protective foods will suffice for 10—15 years old children as is required for the 5 year old child.

7. General recommendations:

(a) Although a simplified diet may be so constituted from a few protective foods as to be satisfactory, it is a general principle that **variety** in diet tends to safety, provided it contains a sufficiency of the protective types of food materials.

(b) White flour in the process of milling is deprived of important nutritive elements; its use should be decreased and partial substitution by lightly-milled cereals and especially by potatoes is recommended.

(c) The consumption of an excessive amount of sugar is to be condemned, and in this case also partial replacement by potatoes is urged.

(d) Milk should form a conspicuous element of the diet at **all ages** and in the case of pregnant and nursing women; skimmed milk or separated milk is of high nutritive value; although deprived of vit. A through removal of fat it retains the protein, vit. B and C, the Ca and other mineral salts

(e) Fresh vegetables and fruits should also form the constituents of the normal Mixed Diet. Adequate provision of the vitamins (other than vit. D) can be readily accomplished by inclusion in the diet of optimum amounts of protective foods. Where these are not available only such vitaminous preparations as are Officially controlled and approved should be permitted.

(f) The Commission emphasises the need for provision of extra vit. D either as cod-liver oil or as irradiated products wherever and whenever sunshine is **not** abundant, especially in the period of growth and during pregnancy.

* * * * *

Another Expert Committee—The Advisory Committee on Nutrition—appointed by the British Ministry of Health recently to carry out a survey of Nutritional Condition in Great Britain and suggest suitable measures, also hold practically the same opinion

as the Technical Commission of the League of Nations, and defines fresh milk, butter, eggs, meat and fish, fruits and vegetables as the best foods and stresses the value of a wholesome quantity of milk in the case of pregnant women and nursing mothers.

It will, thus, be evident that all basic knowledge of Nutrition is in essence the same in every country, and although extensive research in this direction has been carried out in recent years and greater knowledge of the science of Nutrition continues to be disseminated, it is Sir Robert McCarrison that can be said to be the first to observe the need for the simplification of such knowledge for the benefits of the lay public. His book "Food" published in 1928 (Macmillan, Price As. 12.) while Director of the Nutritional Research Pasteur Institute, Coonoor, (S. India) embodies the results of his research in Indian Food values and local problems connected with nutrition. It specially deals with the manner in which those results should be applied to the peculiar problems of inter-provincial conditions in India in respect of food-supply and income-distribution and needs created by climatic, racial, religious and social peculiarities.

McCarrison's investigations were mainly directed towards diets typical of the various classes of the Indian Population, and we have already seen how he favours the typical diet of certain races of Northern India, which combined in it all the necessary elements of a well-balanced diet and which has contributed towards the most remarkable physical stamina and power of endurance of these races. We have also seen how he points out the other extreme, the ill-balanced nature of the Madrassi diet, both of the rich and the poor.

A similar Publication to McCarrison's is the Health Bulletin No. 23 (Government of India Publication 1937 priced only 2 As.) prepared by Dr. Aykroid, Sir McCarrison's successor at the Nutrition Research Institute, Coonoor.

Errors of Diet

A. Over-feeding: This seems to be the commonest tendency among the civilised races especially among the upper

classes in society; a moderate excess of food is probably harmless and may not be much beneficial either; but this limit is apt to be frequently overstepped; moreover, the diet in the Tropics being mostly from vegetable sources contain plenty of carbohydrates and has to be usually taken in large quantity; and the common result of habitual feeding on such large quantity of food is **obesity.** The sedentary habits of the majority that can afford such diet tends to minimise metabolism and to deposit of fat.

Excess of Carbohydrate in dietary. An important dietetic error among the richer classes is excessive consumption of starchy and sugary stuffs. This large intake throws a good deal of strain on the digestive organs giving rise to gastro-intestinal troubles such as diarrhoea, flatulence and cardiac distress by the upward pressure exerted on the heart by the gas-distended stomach and intestines. Considerable strain is also thrown on the internal secretion of the pancreas, which is primarily concerned with the metabolism of carbohydrates; diabetes, therefore, results easily; and though excessive carbohydrates in the diet may not be the only cause of diabetes, the sedentary habits of most of such people go a long way towards the establishment of that disease.

Carbohydrates are not suitable for food in young children, as at that age they are incapable of digesting them from imperfect formation of ptyalin of thé saliva and amylopsin of the pancreatic juice,—the two ferments concerned with conversion of starch into sugar. Infantile Biliary cirrhosis thus results.

As a rule, bodily activities are very much reduced in the tropics and the digestive powers are undoubtedly not so vigorous as in the cold or temperate climates. The European coming out to tropical countries cannot easily give up his original dietary habits of a temperate climate and continues to use a high protein diet consisting mostly of meats he was accustomed to, which is apt to leave a small foecal residue; this combined with the lesser tonicity of intestinal musculature consequent on the tropical heat; tends to produce constipation and intestinal toxaemia, as we noted above; and sometimes mental disturbances like insomnia and tropical neurasthenia result necessitating an early return home.

The question of moderation in eating and drinking goes far beyond an occasional banquet or orgy. Ordinarily we all eat more than what we actually need, and some people eat a good deal more. He who over-eats habitually is laying up for himself a number of ills.

There is an established rule of life which bids one rise from the table feeling that he could eat a little more. But there are many who do not rise from the table until they can literally eat no more. Even animals do naturally turn away by unerring instinct from their food when they have eaten enough, unless they mix with human beings, when they stand a chance of being overfed.

It is the middle aged people that are apt to eat too much and at too frequent intervals, because the pleasures of the table, it is said, become then of greater importance as their capacity for other pleasures of life is gradually waning. As we get older the powers of digestion and the powers of elimination become feebler and for that reason alone less food should be taken than in youth and early manhood. After, therefore, the 50th year at any rate the amount of food should be considerably lessened.

Dyspepsia, which makes miserable martyrs of thousands, not to say millions, is directly traceable to over feeding and wrong feeding, to overuse of starchy and sugary foods, excess of coffee, tea or alcohol and excessive use of iced drinks and ice creams; so also constant use of fried foods, especially highly seasoned meats fried in animal fats. Besides dyspepsia many other ills follow over-indulgence in the pleasures of the table. Uric acid, the cause of the agonising and crippling complaints which go by the names of gout and Rheumatism comes from an excess of meat in diet, and scurvy from a lack of fresh vegetables and fruits. Liver complaints are due to an overplus of rich foods and an excess of alcoholic drinks. Excess of animal food is a fruitful cause of Kidney disease. Atheroma or hardening of the arteries with consequent rise in blood pressure and tendency to apoplexy and death, common in middle aged men might be avoided for years by strict moderation in diet in respect of meats and liqour. Diabetes is yet another complaint due entirely

to indulgence in rich food. There are still a number of other complaints following self-indulgence so much so, it may be said that it is almost literally true that 'we dig our graves with our teeth'.

An old Japanese Proverb says that 'all diseases enter by the mouth;' nothing can be more true, for nearly all our illnesses are the result of various toxins or poisons which are introduced into the body through food drink and smoke.

B. **Under-feeding.** It is astonishing how long the human body can go without food, provided a due supply of water is obtainable. Lunatics have been known to refuse food for four or five weeks at a stretch, and the experience of professional fasters shows that long periods of starvation can be borne without much evil effect, and it is only when the body weight has fallen to $\frac{1}{2}$ or $\frac{1}{3}$ of the original amount that death from **inanition** (want of nourishment) results.

In cases of acute disease the physician might flatter himself that he has been keeping his patient alive by rectal feeding, for example, but the patient is really all along "living on his own tissues." Nor need we be unduly alarmed if a well nourished patient is unable to take any diet at all for some days, as his own reserves will be able to tide him over the crisis without much harm. A non-meat-eating Hindu, who observes periodic fasts can, therefore, be said to be really feeding on his own "body meat".

Habitual underfeeding is more injurious than the opposite condition of "over-feeding." The deficit in the diet may be an all-round deficit i. e., in all the most essential constituents of food, but it is more usual to have a deficit in only one or other of the constituents; in other words, an ill-balanced diet is more frequently met with than an insufficient diet and is the commonest form of underfeeding; and, as proteins and fats are usually costlier than carbohydrates it is more likely that proteins and fats will be lacking rather than carbohydrates. We have seen that insufficient protein intake results in insufficient tissue repair with the consequent production of "pallor and puffiness" characteristic of the underfed, and this observation has been confirmed

by experiences gained in the late World-war of 1914-18. 'War-oedema' among the Germans was probably the result of too little protein. Too little fat in the diet usually arouses a craving for fat itself and incidentally to the two vitamins A and D contained in most fats especially of animal origin; and it is the experience of all dietecians that "an all round low intake of calories during the growing period of entrants into Public Schools was followed by a deficit in their height and weight during the next 10 years." It must be noted, however, that experience of the War has shown that it is possible for life to be maintained and normal work carried out on a diet very much less than that to which an individual has been accustomed. This is explained thus:

"The first effect of diminution of food is a diminution in the weight of the body; the individual, if he remains at his work, puts out at first the same amount of energy as before, the energy lacking from the food supply being made good by the fat and muscular tissue of the body itself. But when under this regime of diminished supply of food the weight of the body has fallen by 10 to 12 p. c. it is found that his basal requirements are largely reduced, as we have seen already; that is to say, under the altered conditions of food supply the body processes also are carried out more economically, and there is no diminution in the actual expenditure of energy required for doing a certain amount of work, the individual being more economical in effort and "economising his muscular activity to the utmost possible extent." This state of economical nutrition seems to be without danger to health even when extended over some months. But when extended over years, as happened in Germany during the War, the general effect appears to be a diminution in the power of resistence to diseases like Tuberculosis; the effects of insufficient feeding in diminishing resistence to cold has already been alluded to; its effects in producing liability to disease in general were well illustrated in the out-breaks of relapsing fever and typhus which followed the potato famine in Ireland in the early part of the present Century, and similar results have repeatedly been witnessed in India and elsewhere, "fever and plague dogging the footsteps of famine."

It is common experience that exposure to infection is especially apt to be dangerous on an empty stomach, as, for example, before breakfast, a fact which it is important for Doctors and Nurses to bear in mind.

The Tubercle bacillus seems to find a peculiarly favourable soil in ill nourished persons. The association between bad feeding and such a disease as "consumption" is well established, while an improvement in nutrition is not infrequently followed by a cure.

The bad effects of underfeeding in children have been to restrict growth, and experiments on animals have shown that a return to normal conditions has been followed by an increased rate of growth, sufficient to make up for that lost during the period of underfeeding; and the fact that the bad effects fall heavily on the young and the growing has been recognised even from the days of Hippocrates, who devoted a special aphorism to the statement of it. "Old men" it runs, "bear want of food best; then those that are adults; youths bear it least, more especially children, and of these the most lively are the least capable of enduring it."

The remote results of under-feeding are not less injurious than its more immediate results. Amongst such results, impairment of the digestive power is very conspicuous, and a kind of disuse-atrophy of the digestive organs is the result and is often seen in dyspeptics. The more their nutrition fails through not eating the less they are able to digest and the first step in curing their stomach troubles must often be in the direction of compelling them to eat more.

It is an interesting question whether the effect of townlife in impairing digestive power may not be partly responsible for the habitual under-feeding so often found among town dwellers. It is possible in other words that the town dweller may in many cases be incapable of digesting enough food to keep him in an ideal state of physical efficiency.

Another of the remote dangers is in the influence of imperfect feeding upon the human mind. In addition to a lowering of mental power there is a feeling of dissatisfaction and

depression culminating sometimes in melancholia and irritability hallucinations and even madness evidently from imperfect nutrition of the brain.

A hungry man is an angry man and the proverbial good nature of the English man is perhaps associated with the fact that he is as a rule full fed.

To sum up: Besides the "deficiency" diseases like keratomalacia, beriberi, scurvy, rickets and osteomalacia caused by the deficiency in the diet of one vitamin or other and salts of Ca, P and Fe, there is the disease—pallagra supposed to be brought about by the deficiency of proteins and probably vit. B_2 also. There is still a large circle of disorders arising from gastro-intestinal disturbances like dysentery, diarrhoea, sprue etc.—the result of dietaries poor in vitamins and proteins and rich in carbohydrates and fats. Decay of teeth is due to the common use of white bread or polished rice deficient in Ca and P salts. Cancer is often attributed to lack of Potassium salts in the blood and Tuberculosis to lack of Ca in the blood. Excessive use of starchy and sugary foods brings about diabetes especially with lack of exercise. Now, most civilised people are more or less unwell from the effects of chronic shortage of one or more vitamins or salts or proteins or all combined, which in the long run lead to poor physical development, lack of recuperative power and endurance, want of resistence to disease and infection and quickening of senile changes and old age.

Tuberculosis is eminently a deficiency disease, says Dr. Muthu—deficiency of fresh air and light, deficiency of proper nourishing food, of sufficient exercise and sufficient rest; and chronic want and poverty are the commonest causes of Tuberculosis among the poor and middle classes in India.

C. Faulty Nutrition and Experimental Production of Disease

With the object of learning how far the foods eaten by the people of India are related to disease, McCarrison conducted experiments on animals fed entirely on the actual Indian dietary. He draws the following conclusions;

"The morbid states encountered in cases of improper diet included all forms of disease of the lungs, of the nose and accessory sinuses including otitis and adenoids; diseases of the eye, Gastrointestinal diseases like cancer and ulcer of the duodenum, diseases of the urinary tracts, of the reproductive system including death of the foetus **in utero** and premature birth, diseases of the skin, of the blood, of lymphatic and other glands, of the endocrine system, of the nervous system like nervous instability and polyneuritis, diseases of the heart and general oedema. Not infrequently they were found to be suffering from more than one disease. In some cases crooked spines and distorted vertebrae were also found."

It will be seen then, from the above list that there is probably no ill flesh is heir to which cannot be connected with faulty diet.

[Without meaning any disrespect whatever to McCarrison, this reminds one of the story of "Three men in a Boat" by Jerome K. Jerome; one of them was impelled whenever he read an advertisement on patent medicines to the conclusion that he was suffering from the particular disease therein dealt in its most virulent form. He, therefore, consults a medical Dictionary in the British Museum and goes through its pages from A to Z, imagining all the while that he had some part of his life all the diseases from Ague to Zymosis, except the House-maid's knee].

"On the other hand" McCarrison continues, "hygienically-housed animals and fed on a well balanced diet composed of natural foodstuff so combined as to provide in proper amount and form, the proportion of all elements and complexes necessary for normal nutrition, showed not only freedom from disease but lived a long life also. Premature deaths were rare in them except by accidents."

Two diets were employed by McCarrison to test their effect on the production of disease: One resembling that eaten by the poorer classes in Madras, consisting of rice, chillis, Tamarind, a little fish and "Conjee;" the other, approximating the diet of the poorer classes in Travancore, consisting largely of Tapioca root (which is the staple food in those parts), rice, a little fish, chillis and rice water.

Both these diets were very poor not only in salts and vit. A B and C but in respect of proteins also. In either of these classes of animals the incidence of gastric ulcer was 11 and 28 p. c. respectively. Here is an explanation, then, why gastric or duodenal ulcers are common in South India especially in Malabar.

[We have personally seen tens of these cases in Malabar and Madura, and operative treatment is the only form of treatment that has succeeded so far. On the supposition that either the want or deficiency of vitamins is the prime cause some observers have reported excellent results in the treatment of gastric ulcers by means of either vitamin—rich foods or foods supplemented by vitamin—extracts].

Hygiene of Diet

Even physicians often neglect or under estimate the effects of emotional states upon body-nutrition. Repeated scientific experiments and observations have demonstrated direct bearing of the emotions upon the digestive mechanism. Fear, worry, disgust, anger or pain may stop or reverse the movement of the digestive tract, or they may even decrease or suppress the secretions. On the other hand, we may have a psychic increase in tone, activity or secretions brought about by good mental states. In this field is to be found the explanation for many of the puzzling problems of digestive and nutritional disorders.

Application of these facts to the hygiene of diet consists in a careful study of the emotional states of the patient in relation to the intake of food; in the case of grief or anger it is common experience that the appetite is checked. Social surroundings of the home, school or business may compel the taking of food under stress or haste with its attendent problems, and discovery of the cause and the substitution of good mental states will be followed by favourable effects on digestion and nutrition.

Food—likes and dislikes, the environment in which the food is served, its preparation as to appearance, taste, odour may influence the digestion by either improving or retarding it. A good deal thus depends upon the way in which the food is

presented to the eye—a clean table cloth, decorated with flowers and pleasant cheerful surroundings make all the difference. In fact the sight of a dirty table cloth or plate might check the flow of the gastric juice itself and spoil the appetite. These factors should always be considered, and no supervision of diet is complete that neglects these factors.

Fatigue has an untoward effect on digestion, for it directly influences both the character of the muscular movements and the extent of the digestive secretions. The question, what influence have exercise and rest on digestion is probably one of blood supply of the stomach; gentle exercise by increasing the rapidity of the circulation may aid the secretion of the digestive juices and stimulate the movements of the stomach and intestines; but severe exercise by diverting much blood and nervous energy to the muscles has probably an adverse effect.

Sleep is only useful as an aid to digestion in the case of invalids and aged persons, but even in them it may be injurious in some instances by depressing the general circulation.

It is said that the best employment after a heavy meal is "frivolous conversation" which keeps the heart active without making great demands on the brain.

One of the commonest hygienic errors of diet is to eat soon after severe exercise or work without a period of rest sufficient to secure recovery from acute fatigue.

Chronic fatigue is one of the banes of modern high-tension life and is common both among children and adult population. This type of people, therefore, need more rest, not more food.

The technic of eating has one important hygienic bearing. Proper mastication is the first step in normal digestion, and rapid eating is harmful and many a case of dyspepsia is kept up, if not actually produced by imperfections of the teeth.

A survey of the health habits of a large number of young adults reveals a high degree of correlation between late hours, insufficient exercise, irregular action of the bowels and "bolting of food" (just as one posts letters) on the one hand and poor nutritional status on the other.

Hunger. The sensation of hunger is one of the drives that

assures the maintenance of bodily supplies of nutriment. Hunger is a general term and the sensation itself is referred to the stomach. Hunger is not a safe guide to nutrition even though the common folk largely believe this to be true.

Appetite is psychic as well as physical and expresses both the desire for food and a relish of the food when taken. It tends, psychically of course, to raise the level of nutrition by improving the tone of the digestive musculature and increasing the digestive juices. The appetite of the individual with normal nutrition should be regular and hearty. A capricious appetite means a psychic abnormality and is a danger signal.

The need for a proper diet in the treatment of disease has been recognised from the days of the Ayurveda, and the following is from Lolambarajiya (Vaidya Jeevan).

पथ्ये सति गदार्तस्य किमौषधनिषेवणम् ।
पथ्येऽसति गदार्तस्य किमौषधनिषेवणम् ॥

Which means: "When there is proper food for the patient, what is the need for medicine? when there is no proper food for the patient what is the use of medicine?"

III. Dietetic Value of Various Classes of Foodstuffs

Judged by the present criteria of adequate nutrition a knowledge of the dietetic values of the important groups of food materials will be of immense practical value.

ANIMAL FOODS

Cow's Milk

Chemical composition of cow's milk is:

Water	85.3 per cent.
Fat	5.8 ,,
Proteins	3.5 ,
Lactose	4.5 ,,
Inorganic salts	0.7 ,,

Milk can be the sole diet of Infants for a considerable length of time and as we have seen, it supplements to diet of growing children and adults at so many points that it can well serve as a suitable foundation for all well formed diets. One quart of milk yields about 700 calories and contains one ounce of protein (casein and lactalbumen) of excellent quality from the point of view of amino-acids make-up; the proteins, besides, are kept in perfect solution by the partnership with Ca salts. The fat(butter) contained in milk is not only in a finely emulsified state and as such readily assimilable but is associated with a large quantity of vit.A. Lactose (milk sugar) exerts a beneficial influence in the intestines, where by fermentative production of lactic acid it exerts a favourable influence on the acidophilic bacteria present in the bowels. (We shall come to this point again when we deal with butter milk and Koumiss.)

Milk is rich in salts of Ca and P in the ratio particularly favourable to storage in the tissues, but it is distinctly deficient

in Fe. It may be questioned, how then, the entirely milk-fed young infant is to obtain its supply of Fe; this scarcity of milk in Fe is a matter of little moment to the infant as it enters the world with a large amount of Fe obtained from the mother's blood.

All the vitamins have been detected in milk but it is a liberal source of at least two of them, viz., vitamin A and B. The antiscorbutic value of milk (vit. C content) is variable and depends to a large extent on the vit. C contents of the animal's fodder; cow's milk has a relatively small concentration of vit. B_1 and B_2 (G), while human milk has only half as much of these factors as cow's milk. It is obvious therefore that cow's milk cannot be considered as a potent source of vitamins except vit. A. This is the reason why a sufficient quantity of fruit and vegetable juices should be given to children brought up entirely on boiled or even pasteurised cow's milk, because vit. C, as we have seen is destroyed by heat.

The vit. D content (antirachitic principle) of cow's milk is very poor also, and children reared on it should have plenty of sunlight, or if this is not available 20 to 30 drops of Cod liver oil after each feed.

Quality of Milk. Both from the economic and dietetic points of view it is advisable to have a standard by which the quality of milk could be judged; and seeing that it is the solids contained in milk that we want and not the water it may be supposed that the specific gravity of the milk would be a sufficient guide for all practical purposes. The average Sp. gr. of a good sample of milk is between 1026 and 1032 that of water being taken as 1000.

Now fat is lighter than water and this is the reason why it rises to the top as cream when milk is allowed to stand. Hence, a specimen of milk plus its cream has an actually lower Sp. gr. than one from which the cream has been removed. The artful milk vendor knows this, so he skims his milk and then lowers its Sp. gr. by the addition of water. He can thus effect a double adulteration; adulteration in quality and quantity—without lowering the Sp. gr. of the milk. To detect if milk has been adulterated with water note the Sp. gr.; good milk has a Sp. gr. of 1024

to 1034, and when allowed to stand for a few hours in a tall cylindrical glass vessel, the cream collected should not be less than $\frac{1}{10}$.

Skimmed milk. Now, fat exists in milk in the form of an emulsion of extraordinary perfection. When milk is allowed to stand the fat being lighter, we said, rises to the top as **cream.** If this is removed ''skim-milk'' is left While whole milk contains about 5 p. c. of fat skim-milk contains only 1 p. c. and if the cream is removed by means of a centrifugal separator a larger percentage of fat goes with the cream leaving only about ⅛ p.c. in the skim-milk. Skim-milk is therefore, digested by the stomach much more easily than whole milk.

As soon as milk enters the stomach it ''Coagulates'' or ''clots'' due to a change brought about in the casein by the ferment, 'rennin' contained in the acid gastric juice. After the clot of casein is formed in the stomach it shrinks into a leathery mass, offering great resistance to digestion. The thicker the milk (i. e. the greater the quantity of solids contained in it) and the greater the acidity of the gastric juice, the denser the clot becomes, and the greater is the difficulty of digesting the milk.

''Clotting'' of milk as taking place in the stomach, has to be distinguished from ''Curdling'' of milk occurring in Nature by the action of a special ferment converting the milk into curds and changing the sweet lactose (milk sugar) into the sour lactic acid. When milk ''curdles'' its casein is simply thrown down in the form of a precipitate without undergoing further change, (but when milk 'clots' the casein undergoes certain changes which renders its digestion more difficult). Hence it is that curdled milk is more easily digested than milk itself.

The production of lactic acid is due to a splitting up of the lactose contained in milk by the agency of certain organisms (Bacterium lactis) normally present in milk, the growth of which is facilitated by certain external conditions, of which warmth seems to be the chief; that is the reason why milk readily turns sour in the hot weather. If the milk is boiled these bacteria are killed, such a milk keeps better and longer without turning sour. Boiling or pasteurisation destroys also disease germs from milk and renders it ''Sterile.''

Milk, as it comes from a healthy and perfectly clean Cow may be regarded as a sterile article of food and it is even said that it has mild germicidal properties. Such ideal conditions are, however, difficult to attain in practice.

We said above that the density of the clot which milk forms in the stomach depends upon the thickness of the milk on the one hand and the acidity of the gastric juice on the other. It follows then, that by reducing the proportion of these two factors, the clotting of the milk can either be prevented or so altered as to render the clot much less dense. Obviously, therefore, simple dilution of the milk with water is sufficient to increase its digestibility, and dilution with either aerated water soda water or lime water by virtue of the alkali contained therein, will produce the same effect by neutralising part of the acidity of the gastric juice in the stomach. Barley water is also useful for this purpose, its action being probably due to the slight degree of viscocity which prevents the 'clot' from shrinking into a tough mass. For the same reason rice-gruel and oatmeal gruel are much better substitutes to barley water, being more nutritious also than barley water.

Boiled milk is said to be more easily degestible than unboiled milk by the human stomach, as some of the Ca salts contained in the milk are precipitated by boiling and the 'clot' is thereby rendered more flocculent.

The clot formed in the stomach can be rendered friable by the addition of citrate of sodium to milk, 10 to 15 grains to the pint; sodium citrate acts by converting some of the soluble lime-salts into insoluble calcium citrate. Citrated milk is extensively employed in feeding infants and enables the employment of whole milk without dilution with water or gruel; the presence of the citrate, however, cannot be detected by the taste, and milk naturally contains so much of Ca salts that the removal of part of them from it by the addition of the Sodium citrate is no disadvantage whatsoever.

Thickening the milk with a little corn-flour or rice-gruel or mixture of milk with some other kind of food, such as bread, rice etc. as in making porridge not only renders the milk itself more

easily digestible but the mixture itself is also rendered easily digestible; and we have seen that combination of milk with any other article of food raises the biological value of that food-stuff also.

One property of milk has been found to be its tendency to augment the secretion of the gastric juice in the stomach independently of reflex nervous influences, such as watering of the mouth at the sight or thought of food. This property does by no means obtain in any other food even including 'soups' and marks milk as the most ideal of the invalid foods.

Milk ordinarily causes constipation, but in some, it produces diarrhoea and the addition of a little tea or coffee to milk might overcome this condition.

Milk slowly sipped is more easily digested than swallowed in gulps. Being a fluid milk is easily swallowed; this is a great advantage especially in the case of exhausted patients and the quantity administered may also be measured. Being quite bland it is nonstimulant and is a useful diuretic in cases of gout and dropsy from kidney disease and in some forms of Asthma.

Provided that the milk is not contaminated skimmed milk is best used fresh without boiling.

The alkalinity of milk has been availed of in diseases of the stomach, such as ulceration and some forms of dyspepsia, in which there is an increased acidity in the stomach. Moreover the fat contained in milk exerts a restraining influence on the amount of gastric juice also, so that milk can be considered an excellent article of diet in those conditions.

Skimmed milk being more easily digested is particularly useful in the case of invalids and in all conditions of intestinal and liver disorders.

Hygiene of Milk and Milkborne Diseases

We have seen that milk is an article of diet essential for Infants (and many of us for months had no other food); and for sturdy youth it is also helpful, if not quite necessary in adult age. None can deny that one of the greatest dietetic needs of our Country as a whole is an abundant supply of good milk. Every

effort should, therefore, be made to secure for the population an adequate supply of milk of the highest quality and purity and at the cheapest rate possible; by purity we mean freedom from those frequent contaminations that are both repellant and harmful.

The good effect upon youth of the addition of milk to the diet is shown by the investigations carried out under the authority of the Medical Research Council by Dr. Corry Mann. He found that the addition of a pint of pasteurised milk to the daily diet of growing boys converted an annual gain of weight of 4 lbs. per boy into one of 7 lbs., and the average increase in height from 1.84 inches to 2.63 inches. Japanese children brought up in the farms of California with milk, butter and other dairy products are taller and more vigorous than the children of the same age living in Japan; so also the children in Bournville Garden City, near Birmingham, taller and heavier in weight than those of the same age in Birmingham City itself. These increases were proved to be due not to the small increase in the "fuel" value of the additional milk, nor to its extra protein but to the **specific qualities** of milk as food, and we have already seen how milk helps the digestion of other foodstuffs taken with it and adds to their biological value also.

Milk should be obtained from the **healthy** mammary glands of a **healthy cow,** but it is rarely so. Milk is often contaminated with the animal's excrementa, hair, dirt, sweat or even purulent discharges from the udder, dust of the streets during transit of the milk and unclean matter from vessels used for milking or for delivery. It was once calculated by Dr. Backhaus that the inhabitants of Berlin consume in this way 3 cwts. of excrementitious matters *per diem.*

A great variety of acute and chronic diseases are attributed to milk; the germs of such diseases grow and multiply rapidly in milk as it affords a suitable medium for their growth. Among the most important are Surgical Tuberculosis in all its forms, Typhoid and Paratyphoid fevers, diphtheria and scarlet fever, septic sore throat and other forms of infection, gastro-enteritis and summer diarrhoea of children or of adults, Cholera, dysentery and so on.

Some of these however, are due to spreading of the infection through contaminated water used by the milk man to wash his hands or utensils or for adulteration of the milk.

Milk and Tuberculosis

The most serious, though perhaps the least obtrusive of all forms of milk-borne diseases is Tuberculosis. Surgical tuberculosis had existed from the earliest days of human history, as specimens of its ravages upon the Spine have been found in Neanderthal man and in mummies of ancient Egypt.

The minds of men, says Lord Moynihan, are not so much moved by the evils to which they are grown accustomed as by novel or new fangled and therefore startling events of perhaps far less significance; we are naturally horrified, he says, at the loss of a million people in four years of War; yet we submit without concerted rebellion to the loss in the British Isles of 50,000 people every year from Cancer and of not less than 100 people every day of every year from tuberculosis, though some proportions from both are certainly preventible, From 1921 to 1928 there were over 320,000 deaths from Tuberculosis; of this 'white plague,' Tuberculosis, there are two forms:

(1) The **human** form derived from contact with those suffering from consumption (Tubercle of the lungs) and (2) the **Bovine** (derived from the cow through the milk) causing most of the conditions known as the Surgical Tuberculosis—which affects bones, joints, glands, intestines and vertebrae. A large proportion of these cases derive their infection through tuberculous milk. The infection falls first, say on the tonsil, whence it is conveyed to the glands of the neck, where it causes enlargement and perhaps suppuration. Every one has seen the scars resulting from abscesses so caused; in other cases the brunt of the disease is borne by the bones, and numerous operations for the removal of pieces of dead bone may be necessary and even amputation of a limb.

There are no statistics of the mortality of Tuberculosis and such lists as we possess do not by any means reveal the truth. Not all people who suffer from Surgical Tuberculosis die from it

though all who die from it have as a rule suffered miserably for months or years. The deprivation of health, strength and vigour which occurs in both forms of Tuberculosis lays the patient open to attacks of other infections to which he falls an easy victim, and to this new disease death is usually ascribed, though Tuberculosis opened the gates for the entrance of the new and fatal disorder.

Many of the cripples we see in the streets, those with bent backs and warped limbs owe their miseries to infected milk; those with thick, swollen and perhaps suppurating necks, called "scrofulous" from their resemblance to the pig, and those whose hips and knees are twisted or stiffened are also the victims of a disease which may be conveyed to man from the cow.

Other Diseases conveyed by Milk

Though Tuberculosis is the most insidious and dangerous of the diseases transmitted from the cow to man by infected milk, it is not the most dramatic. Several cases of septic fevers believed at first to be Influenza were finally traceable to milk. Several epidemics of scarlet fever have been traced to milk-borne infection. Epidemics of diphtheria, typhoid fever and Cholera could often be traced to infected milk; and the list could be continued. But although these acute epidemic out breaks of disease caused by milk are disturbing and attended not only by grave morbidity but by a small mortality, they are negligible in comparison with the permanent serious problem of Tuberculosis.

The problem, therefore, is not so much with the value of milk, about which there are no two opinions, as with an increased supply of milk and that **above suspicion** i. e. which carries no disease germs with it. Now, how is this to be secured? The problem of milk supply is in part an agricultural problem and in part a financial problem. It is agricultural in that it rests upon the farmer and dairyman to produce milk and to ensure, if it be possible economically, that the milk so produced shall be free from injurious or lethal contaminations. Experts have recognised that much may be done by improving agriculture to increase the quantity and to improve the quality of milk provided for human consumption; but the problem had not been adequately

attacked in this Country until lately an impetus was given to it by our present Viceroy. The question of mass nutrition in India and how to improve their food supply in general and improve its quality was discussed at the Indian Science Congress held in January 1937 at Hyderabad, Deccan, under the presidency of Col.Olver, Animal Husbandry Expert. We have already discussed this question under Introduction.

Now, Veterinary experts are of opinion that more than 50 p. c. of cows producing milk for human consumption, are tuberculous and that the largest percentage of Tuberculosis in children, especially scrofula, joint affections and glandular enlargements, owe their origin to infected milk. "To say these truths in the language of the laboratory" as Moynihan puts it, "milk containing living active Tubercle Bacilli taken from the diseased cows is placed in a medium most favourable for its culture, namely, the medium of the young, active and succulent tissues of the growing children, and in many cases the children in an incubator (known in the Municipal language as the 'Slums') in order that every facility and all necessary pabala or food for propagation may be lavishly supplied"

To ensure that pure milk should be given by the cow and protected from contamination both during transit and delivery is a problem of complexity and of difficulty, which seems to increase with one's growing knowledge of it. The primary truth is clear, viz., that tuberculosis of bovine character in man is consequent upon Tuberculous disease of cows and upon nothing else. The only solution that naturally occurs to any one is that the affected animals should be slaughtered and only healthy ones allowed to survive. But in practice such a suggestion will be of no value, because it is difficult to determine with absolute certainty which animals are free from the disease (tubercle) and which are not. Diseased animals may then be overlooked and these would soon contaminate their mistals, and owing to the viability of the Tubercle bacillus, within a generation the trouble would be as wide spread as ever.

How are we then, to render our milk supply safe for our use? There are a variety of ways of doing this:

(1) The simplest and most obvious is the boiling of milk; this destroys the Tubercle bacillus and other bacteria; but it affects the quality of milk as food not by reducing its nutritive value—in fact, it is on the other hand increased—but by reducing the Ca and P content, by injury to the vitamins and by causing other changes not yet fully understood. These disadvantages are, however, negligible and easy of compensation by the consumers themselves.

(2) Pasteurisation is equally effective. Fig. 2. It consists in heating the milk to a temp. of 142° F. to 150° F. in a closed

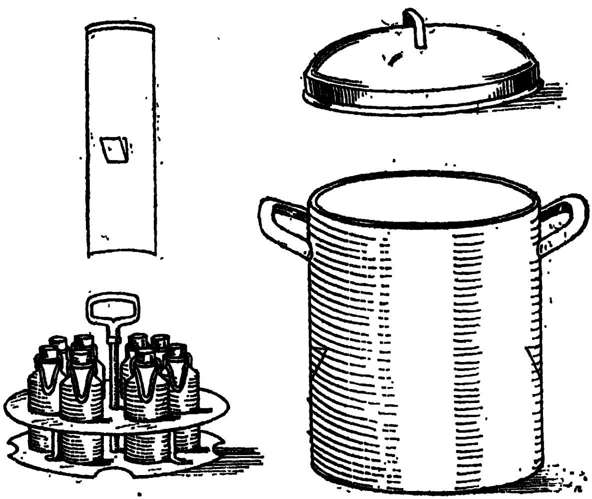

Fig. 2. Home-Pasteuriser.

vessel and holding that temp. for 30 minutes. The cream is not thereby affected in quantity; the breaking up of the cream may also be done as a part of the Pasteurisation process as the taste of the milk is thereby improved also.

Pasteurisation should be carried out with care, carelessness means disaster; because although the disease-germs contained in milk may be destroyed by Pasteurisation, the subsequent contamination of the milk should also be carefully

prevented. Want of care in this respect has in many instances produced illness among consumers of even pasteurised milk.

Hence the conclusion, that pasteurisation carefully and faithfully carried out affords adequate protection against Tubercular infections, improves the flavour and taste of milk, reduces the Bacterial content to the lowest level and that little deterioration results, provided no efforts to improve the milk at the source are spared, as by careful inspection of cattle and of the procedures in milking and of transport. Proper care in this respect ensures **clean** milk, and pasteurisation when adequate ensures **safe** milk.

For ordinary purposes there is little doubt that simply boiling the milk for 20 to 25 minutes is the simplest and most satisfactory method of procedure. It is more advantageous and can be conveniently carried out in the private house. The milk is not deteriorated either in nutrition or flavour, especially if it is rapidly cooled after removal from the fire and well-stirred before use; this effects a uniform mixture of the cream (Homogenisation as the process is called).

To conclude: 1. An increased supply of milk is our urgent need for the wellbeing of the Community and should be encouraged.

2. Although clean raw milk is much better than boiled milk, it is not always above suspicion except under scrupulous care, and the best method of rendering it safe is by boiling or Pasteurisation. Each has its advantages and also disadvantages, but the latter are easily capable of recompense.

3. There is every reason to advocate the habitual application of one or other of the above methods to milk before it is consumed as food, and one looks forward to the day when the drinking of raw milk will be considered as barbarous a custom as the eating of raw meat is at present.

Preservation of Milk

Milk can be preserved by:

(1) Pasteurisation or raising the milk to a Temp. of 167° F. for 30 min. and then rapidly cooling it. All the pathogenic

microbes are destroyed by this process and the souring of milk is delayed for 48 hours by inhibiting the fermentation process.

(2) "Buddeisation" of milk—by the addition of Peroxide of Hydrogen to milk and heating to a Temp. of 51°C for 3 hours. Buddeised milk remains normal in taste and keeps fresh for about a week.

(3) Drying milk by passing through overheated rollers so as to reduce it to a fine powder.

(4) Addition of antiseptics like formalin, boric acid etc.

(5) A new method has been described by Davis of the National Institute for Research in Dairying. It consists of adding a certain quantity of dilute hydrochloric acid to milk and maintaining it at about 37 or 38° F. In this way the milk can be kept for a fortnight. When in use it can be brought back to its original taste and flavour by the addition of the same quantity of dilute Caustic Soda solution.

This method is said to remove one of the minor annoyances of ocean voyages of up to a fortnight's duration, and to be useful in time of war, when delays in transport may be both unpredictable and unavoidable.

Goat's Milk

Goat's Milk is perhaps a much better article of food than Cow's milk for several reasons, and it is strange that it has not received sufficient notice by the medical profession in India; perhaps the prejudice against the use of goat's milk is due to the prevailing idea that goats have a disagreeable odour about them; this may be true in respect to the male animals but the female is absolutely free from any disagreeable smell. Moreover, in most of the Hindu houses the cow is reared in preference to the goat as the cow is held by them in great reverence as the Kamadhenu.

The properties of goat's milk compared with cow's milk give it a distinct advantage.

1. In the first place, goats are not subject to Tuberculosis, so that their milk may be said to be free from suspicion of that taint. It is clear, then, that this immunity possessed by goats should be transmitted through their milk and that it accounts for

its beneficial effects when supplied to tuberculous children. Goat's milk is, therefore, not only free itself from tubercle bacillus but also possesses **special immunising** properties.

2. It is generally known that goat's milk is more digestible than cow's milk and that children fed on it **never vomit hard curds** as they do when given cow's milk, but what they bring up is of a flocculent nature like the vomit of a child fed on the mother's breast-milk.

3. The nutritive value of goat's milk is quite equal to and in cases of wellfed goats much superior to that of cow's milk.

4. The digestibility of goat's milk is demonstrated beyond argument when supplied to delicate and weakly children.

5. Goat's milk, though devoid of vitamins of any sort, may have some medicinal value in it, as the goat, unlike the cow, eats all sorts of herbs and leaves, some of the active principles of which may find their way into the milk. It is strange that the goat which does not object to eat even the bitter leaves of Nux Vomica has great aversion to the common Vasaka plant, which is therefore known in Malayalam as **Aduthoda**, i. e. the herb which "the goat does not even touch."

Hence the goat should more generally be used as the source of milk supply in rural parts and especially at Sanatoria where the more able patients could be employed in looking after them, gaining experience thereby in the management of animals and gaining also the benefit of a healthy occupation.

Goats are liable to infection, however, by certain parasites and also to infection of Undulant Fever (Mediterranean Fever) which has been proved to be transmitted through **cow's milk** also. The goat cannot, therefore be considered the sole carrier of this disease.

Measures should, therefore, be adopted to improve the breeds of goats also by selection of the best types to breed from and prolong their period of lactation and improve the quantity and quality of milk yielded by them. While goats can easily and economically be kept in country parts, it is surprising why this source of milk supply is not much resorted to by our people.

Buffalo's Milk

Buffalo's milk is much thicker than cow's milk or goat's milk and therefore has a higher sp. gr., and the casein and fats are in much larger amount also. Undiluted it forms a thicker clot in the stomach.

"The fat and casein of cow's milk are more easily digestible than those of buffalo's milk; cow's milk has greater amount of vitamins than buffalo's milk; these qualities affect children and adults equally but an adult can digest buffalo's milk, while a child cannot"—these are the observations of Prof. Sahasrabhode of Poona.

Buffalo's milk is richer in fat than cow's milk and is largely used in the preparation of butter and ghee.

*   *   *   *   *

Percentage Composition of Milk of Common Animals

	Water	Fat	Protein	Lactose	Inorganic Salts
Cow's milk	85.5	5.8	3.5	4.5	0.70
Goat's milk	86.88	4.07	3.76	4.64	0.85
Buffalo's milk[1]	82.35	7.51	5.05	4.44	.75

Sour-Milk (Curds, Butter-Milk)

Souring of milk is due to the action of lactic acid ferment normally present in milk converting the sugar of milk (lactose) into lactic acid. Various ferments are in use. The common ferment used in India to convert milk into curds—Dadhi—is a form of Streptothrix (Streptothrix—dadhi Chatterji) having characters similar to those of the Bulgarian Bacillus (the ferment of Koumiss).

The milk is first boiled and when cooled it is inoculated with a little sour milk from a previous preparation; fermentation then starts and is complete within 12 hours.

When curds are churned butter separates and can be skimmed off, and butter milk is left. As butter consists mostly of fat and major part of vitamins, the butter milk comes to contain very little fat, a certain proportion of vitamins (vit. B) and practically all the salts and lactose of the milk, but part of the lactose converted into lactic acid. Butter milk, therefore, resembles skim-milk but is more easily digested owing to the fact that its casein is present in a finely flocculent form. The nutritive value of butter-milk is considerable, an ordinary glassful yielding nearly as much nutriment as 2 oz. of bread. Butter milk has diuretic properties; this is of great advantage both in health and in many cases of disease; being fat-free it forms a good diet in jaundice, hepatitis and sprue. It forms a refrigerating drink in the Tropics and is commonly resorted to in the hot weather. Butter milk should always be taken after food or with the last course of the meal.

Butter milk is a household antidote to ganja, tobacco and arecanut poisoning.

The action of lactic acid on the fermentative (acidophilic) bacteria in the Intestines, especially the Colon Bacillus, is according to Prof. Metchnikoff, a beneficial one, so much so that Bulgarian milk (Koumiss) was once regarded as a panacea for all human-ills and tended towards longevity, and butter-milk came to be used in the dietetic treatment of sprue, colitis, fermentative-diarrhoea, constipation, gout, arteriosclerosis and some forms of skin disease and erysipelas.

Milk as Food

If a man should live on milk alone he may have to consume daily not less than about 7 to 8 pints of milk in order to obtain the necessary amount of nutriment to keep him in health,—as milk contains, in itself, as much as 85 to 90 p. c. of water. The bulkiness which its richness in water entails may, therefore, be considered a drawback to its use as a sole article of diet in most cases of illness. But there is no serious drawback as generally patients being at rest and warm in bed require much less amount of nutrition on the whole than the healthy and the active—

in fact about 3 or 4 pints of milk daily will more than suffice in any case of illness.

Concentrated foods are not wellborne in severe disease and the large amount of water present in milk is, therefore, an advantage. Further, the fact that milk does not require much of labour on the part of the stomach and the Intestines for its digestion and absorption, and its peculiar behaviour in arresting the development of intestinal putrefaction mark milk as an **ideal food** and of special value in stomach and Intestinal disorders.

The use of milk in gout has been already mentioned being non-stimulating unlike meat. The excretion of uric acid in gout is greatly diminished under a "milk-cure." In adopting a milk-cure any fanciful objection on the part of the patient may in the beginning be overcome by a little tact or improving the milk with the addition of sugar or a "dash" of coffee which makes milk more endurable.

Milk, ordinarily in a normal individual constipates, but in some produces diarrhoea. Diarrhoea is due to the use of too rich milk and can be prevented by the addition of a little coffee to the milk.

Constipation caused by milk is usually prevented by following the milk with fresh fruits such as bananas or dried ones like figs and raisins.

There is a mistaken idea among some people that addition of common salt to milk curdles it; salt does not curdle milk, only acids or sour things do.

Whey

When rennet (a ferment related to rennin, the milk-clotting ferment already referred to and is prepared from the stomach-lining of the calf) is added to warm milk and the milk set aside for an hour or two it is firmly coagulated. The coagulum or junket can be separated by filtering through muslin, and the whey drains out. Junket contains most of the casein and fat, while the whey contains nearly all the sugar (lactose), most of the mineral salts and some casein.

Instead of rennet any weak acid such as lime juice or even vinegar can be used to prepare whey. The milk is first boiled and when it has cooled down to a comfortable heat (as judged by touching the milk can from outside) lime juice is squeezed into it. Juice of half a fruit is sufficient for a pint of milk and the whole is set aside. After about 20 to 30 minutes the milk curdles; the whole is next strained through muslin, when, the whey will drain; the curd is then rubbed into the meshes of the muslin so as to enable it to pass through it into the whey below.

Whey prepared in this manner contains practically all the ingredients of the milk in a very fine and consequently more easily digestible form. In fevers like Typhoid fever milk is best administered as whey prepared in this manner.

Koumiss and Kefir

These are in reality preserved milk containing lactic and carbonic acid and a little alcohol. Koumiss is fermented **mare's** milk, its home is in the Steppes of European Russia, and its brewers, the tribes of Nomadic Tartars; the ferment concerned is the Bulgarian bacillus. The lactose of the mare's milk undergoes a double fermentation—production of lactic acid and production of alcohol and carbonic acid. Koumiss is, therefore, more readily digested than "Dadhi" on account of the stimulating action of alcohol and the CO_2 on the stomach mucous membrane.

Kefir is an imitation of Koumiss and is produced by fermentation of cow's milk by means of Caucasian mushrooms or by yeast.

Butter

Butter is obtained by churning milk with its cream or soured milk (curds); the flavour of butter is due to the growth of organisms in the cream during "ripening" or during fermentation of the milk, as butter prepared from sterilised milk or pasteurised milk is devoid of flavour.

Butter is mostly fat and is rich in all the vitamins of the milk and contains a small percentage of water and a trace of

casein in it; and butter cannot therefore keep indefinitely without getting rancid; but when butter is converted into ghee by heat all the water is driven off and the casein becomes burnt. The vitamins of the butter are not affected by boiling and mostly retained in the ghee except the vit. C, in which even the butter itself prepared from boiled and curdled milk is wanting.

Buffalo's milk is largely used in the preparation of butter and ghee as it is much richer in fat than cows' milk.

Butter-fat being in a state of fine emulsion and having a low melting point is very easily digested and assimilated more or less completely; butter consists of butyric and other fatty acids; some of which are quite soluble in water, while others (such as oleic acid)are not soluble in water, but all are akin to fat present in the animal body. The ease with which butter is digested and the completeness with which it is absorbed marks butter as a superior source of fat, even to cod liver oil, for the dyspeptic and the invalids of consumption and oth er wasting diseases; the diabetic do, therefore, derive immense benefit from its use. This quality of butter is lost in the ghee evidently from the mechanical changes brought about by high temperature.

Comparative Fuel Value of Butter and Jam.

The relative fuel value of Butter and Jam as an addition to the dietary is of considerable importance to the poorer sections of the community and involves really two questions, the question of nutrition and the question of cost.

Now, jam consists mostly of refined sugar and so far as nutrition is concerned, jam can, theoretically, take the place of butter, but the quantity of jam will have to be roughly as much as 3½ times the quantity of butter to yield the fuel value of a given quantity of butter, as butter is mostly fat and the caloric value of fat, we have seen, is 2¼ times that of carbohydrates. But in practice it has been found, although one is unable to give any definite scientific explanation, that fats cannot wholly be replaced by sugars or carbohydrates without detriment to health, as refined sugars are, as has been explained already, great irritants to the system and should never be given especially to

children, to the diabetic and to the dyspeptic; the element of vitamins is totally absent from them and much more so from jam.

Even regarding the cost, $3\frac{1}{2}$, parts of jam cost nearly three times the cost in Madras of one part of butter.

We may, therefore, conclude considered from whatever view point jams can never be adequate substitutes for butter.

Cheese

This consists essentially of casein and fat of milk and is prepared by allowing whole milk (cow's) to clot by means of rennet; it is then squeezed and the whey is poured out. If the pressure is high, "hard" cheese is obtained, while a low degree of pressure produces a "soft" cheese. The cheese is next set aside for 'ripening,' which is a kind of fermentation brought about by bacteria resulting in certain chemical changes in the casein with the formation of peptones, part of the casein being converted into fat also. Cheese, therefore, consists of casein, fat and water (in the proportion of 1 to 1 to 1) and a small amount of lactose and salts dissolved in the water. Cheese is not easily digested by the stomach on account of a large amount of fat, for this forms a water-proof coating preventing the access of the digestive juices to the casein. Cheese has, therefore, to be masticated well before swallowing. For this reason hard cheese can be said to be more easily digested than soft cheese, as soft cheese like other soft things does tend to elude the teeth. Once the cheese is digested in the stomach, its absorption in the intestines is easy and complete, nearly 90 p. c. being absorbed. Cheese is, therefore, a highly nutritive food having a high caloric value also, and its food value is more than double that of meat.

Cheese is cheaper than meat and should evidently be of the greatest value in the poor households. But to the poor man, who chooses his cheese as a cheap and efficient article of diet to replace meat it is necessary that he should go in for the best and cheapest kind, and such is afforded by the Canadian or the Dutch make, as in doing so he will get the maximum nutrition for minimum cost.

One of the greatest objections, however, to cheese is the most offensive smell it gives rise to on decomposition, humorously likened by Jerome K. Jerome to "the smell of a dead child."

Eggs

Eggs are peculiarly excellent source of proteins, fats and other food elements contained in the white and the yolk, but not carbohydrates; the proteins of both the white and the yolk are quite adequate for growth. Yolk is rich in P, and contains as much Ca as milk and the Fe of yolk is in a particularly valuable form; vit. A, B_1, B_2 and D are also contained in good quatity in the yolk, which makes egg an article of diet of exceptional value.

Meat

Meat is the best source of protein from the amino-acid stand point and is rich in Potassium, P and Fe, but is deficient in Ca; vitamins are deficient in meat (muscle) but are present in good quantity in the glandular tissues like liver, Kidney etc., which are rich in vit. A, B_1 and B_2.

Eggs and meat are important from the dietetic point, as they provide protein of high quality and Fe in an assimilable form, while the vit. A and B contained in yolk renders a diet of eggs and meat of particular value in the diet of children.

Meat can be said to be one of the few articles of diet on which life can be sustained for an indefinite time. This does not mean that meat by itself constitutes a perfect food, because, we have seen, it is relatively much too rich in protein and too poor in respect of Carbohydrates, fats, salts and vitamins. It would require about 6 to 8 lbs. of meat a day to supply the energy required. Such a quantity is enormous and involves so much of damage to digestion and loss of nerve force, besides overloading the blood with its nitrogenous waste-products.

Meat may be unfit for food because of decomposition or disease. Meat derived from an animal showing signs of disease should not be used as food. Good meat should be red in color, firm and elastic and should not pit on pressure; the odour should be faint and sweet and not disagreeable.

Among the diseases transmitted from animals to man through eating of improperly cooked or diseased meat are Tuberculosis, Trichinosis, Tape-worms and Foot and mouth disease.

Blood as Food

Although it is commonly believed that "the blood is the life" it does not mean and it is not true also that blood represents strength and energy. It is not in itself the food of the tissues but is merely a means of transport by which nourishment is carried from the intestines to the various organs where it is wanted; one might as well say that a spoon is of nutritive value, because it carries food from the plate to the mouth.

It is often said figuratively of course, that blood is thicker than water. Blood infact is not much thicker than water after all and does not contain appreciable quantity of protein or other elements either, so much so that experiments conducted on animals fed on a liberal supply of blood daily showed that the animals were not able to live longer than a few weeks.

Brain of Animals

Consists largely of fatty material containing P; it is easily digested but is imperfectly absorbed.

The idea that animals' brain taken as food can in any way contribute towards nourishment of the brain in the human being has no foundation whatever; "Brains" cannot be had so cheap as that.

Meat Extracts

In addition to proteins and salts meat contains certain substances held in solution in its juice; these are called "Extractives" as they can be "extracted" from meat by means of boiling water. Their exact chemical nature is not quite known and they have not much nutritional value, but are of importance as being the chief cause of the characteristic taste and flavour of meat, and when these are removed as by prolonged boiling the meat becomes flavourless and insipid.

Extractives are to a certain extent stimulants and are used in exhausting diseases.

Fish is very much deficient in these extractives, fish is therefore, not a stimulant; for this reason fish is sometimes recommended in the place of meat for epileptics and for the same reason fish can with advantage be employed by people of sedentary habits and in the hot weather.

Commercial Extracts of meat, such as Liebig's, contain only small quantities of nutriment (albumoses and peptonoids) and Potassium salts; they may, however, serve as good appetizers and pick-me-ups after fatigue or exhaustion of disease or in convalescence. Panopeptones and Liquid Peptonoids are also similar in their composition and effect perhaps with a small amount of alcohol added. Even Liebig himself has said of these Extracts: "They cannot make us strong but make us aware of our strength."

While the title of "food" cannot be denied to these extracts as they do contain a certain amount of peptones and albumoses they are foods only in theory and have to be taken in large quantities to enable them to contribute to real nutrition. It is estimated that in order to supply an invalid with the daily need of protein he requires, as much as 16 oz. of these Extracts may have to be supplied to him. Such a quantity is on the face of it impossible to consume owing to the enormous quantity of salts and Extractives which it would contain. Moreover, the cost of these articles would alone be sufficient to prohibit their use as a common article of food.

Personally we have not much faith in the stimulant properties of these extracts, atleast in doses ordinarily prescribed to our patients, and if the dose should be increased diarrhoea is the result which easily follows in case of Typhoid especially.

There is also the risk of certain irritating fermentation-products being formed in such preparations; and this fact should be noted by physicians and parents, who often suggest such preparations to patients.

Games

Wild rabbits eat all varieties of aromatic herbs and roots and their flesh is, therefore, considered to have great medicinal

value and is immensely used by Ayurvedic physicians in the preparation of certain specifics especially for Tuberculosis and other wasting diseases. The flesh of rabbits used as article of food is said to be easily digested and is prescribed for invalids and people with weak digestion.

Fish

Proteins and fats are the chief nutritive constituents of fish, just as they are present in meat, but fish contains more of P and is more easily digested than meat; and is for this reason frequently recommended, especially the white fish—which is fancifully described as "the chicken of the Sea"—to the Dyspeptic and the convalescent.

Fish, as already noted above, is poor in the "stimulant extractives" of the meat and forms a good substitute for meat in the diet of the epileptics and of the old

The popular belief that fish is valuable as brain food is founded on the supposition that it is rich in P; but there is no scientific evidence in favour of this belief.

'Fish-eating was once thought to produce liability to certain skin affections, especially leprosy and this property was particularly attributed to "salted fish." This theory is now exploded and even in prominent skin-clinics and Leper Asylums fish diet is still continued.

Fish is a cheap and nutritious article of diet among the poor especially in the coastline districts.

Fish is apt to decompose rapidly in the hot weather and has to be gutted and packed in salt or ice to prevent early decomposition. Fresh fish is firm and stiff; while unsound fish is limp, the tail droops, the eyes are dull and sunken and the gills are pale and dirty-looking; the flesh pits on pressure and is easily separated from the bones, whilst the smell is usually appreciable.

Fish may be infected with cysticerci of certain tape-worms and may give the disease to the consumers if the fish is not properly cooked.

Oysters

Oysters are the commonest form of molluscs used as food. It is said to contain **within itself** all the three nutritive constituents of food—namely, proteins, carbohydrates and fats. It is said that Oysters on cooking become tough and more difficult of digestion than uncooked; the carbohydrate contained in oysters is Glycogen, which is the only form of animal sugar known and is contained also in the liver of animals. Oysters are, therefore, unsuited for the use of the diabetic.

Oysters grown in estuaries in which sewage water is allowed to flow might easily become infected with typhoid germs derived from the sewage and have been known to convey the disease to the consumer. This risk, however, can be avoided by cooking but at the cost of diminished digestibility.

Variety of Fish available in the Malabar Coast

The following edible varieties of fish are avaialble in the West Coast of the Madras Presidency, and fish-curing forms the chief industry.

Sardines (S: Longiceps; *Mal: Matti; Kon: Pedva; Tulu: Bhootai*) and Mackerals (*Mal:Aila; Tulu and Kon: Bangudai*) are abundant and are the chief sources of fish oils used in medicine in place of Cod liver oil and in the manufacture of insecticidal soaps. The vit. A contained in Sardine oil is appreciably high in amount. Mackerals however are not a good source of oil.

Fish-cake left after extraction of oil is very rich in manurial elements and is extensively applied to the soil in Coffee and Tea plantations. Fish-meal contains a lot of Ca and other salts containing Nitrogen, Phosphorus and Potash, and is given to cattle, pigs and poultry to improve their tone.

Seers (*Mal: Aikola; Tulu: Anjal; Kon: Visan*) and Pomfrets (*Mal: Akoli; Kon. and Tulu: Manji*) form two chief sorts of table fish; also Cat-fish (*Mal: Eta; Kon: Sangali*), Shark (*Mal: Srava, Kon: Moari*), Solefish (*Mal: Mandal; Tulu: Nang*), Shellfish (*Mal: Kolu; Kon. Kubbe*), Oysters (*Mal: Poondal; Neeli* in *Kon.*) and Prawns, (*Chemmin;* ಸುಂಗಟ) are also common.

Other varieties of Edible Fish, introduced in Madras by the Fisheries Department, are:

1. Catla Fish, originally a native of the Krishna river, is a freshwater fish and is hard, Catla fingerlings standing transport very well.

2. Gowrami, a native of Java and Mauritius, is a large sized fish growing to about 5 feet long and 70 lbs. in weight, boneless and of delicate flavour; can be easily reared in fresh water ponds and is a vegetable feeder.

3. Entroplus Suratensis—is also well adapted for pond culture, palatable and boneless and is esteemed a delicacy. It does not grow bigger than a foot and a half.

Larvicidal Fish, commonly known as "millions" are eaten only by the poorer classes and are helpful in the destruction of mosquito larvae thereby preventing malaria and elephantiasis and yellow fever.

From experiments carried out by the Madras Fisheries Dept. the following species of fish have been found to be most valuable as larvicides, feeding on the larvae of the mosquitoes in stagnant fresh-water ponds and wells.

Haplochilus	—Mandakini	(Tamil);	Sukkachappa	(Tel.).
Panchax	—Paravai	do.	Keethakai	do.
Chela	—Velliche kendai	do.	Bedisa	do.
Barbus	—Kendai	do.	Parogi	do.

In order that they may yield the best results they should be introduced only in tanks free from larger fish of predatory habits (of devouring on smaller fish) such as Murrel (*Koru meenu; Kon: Maggani; Varal*) and Wallago (*Vala meenu, Kon: Karli; Valuga*).

Animal Fats

Animal fats have high energy-value themselves and increase the caloric value of any diet in which they are present. They give palatibility to food and produce a sense of satisfaction. Most animal fats contain vitamins in combination, and are therefore to be preferred to vegetable fats, which are all, except the Red Palm Oil, devoid of vitamins. Butter and Cod Liver Oil are the fats richest in vit. A.

Poultry

The percentage composition of meat of poultry is approximately as follows:

	Water	Protein	Fat	Minerals
Fowl, young	70.0	21.0	8.0	1.5
Turkey	58.0	22.0	9.0	1.5
Duck	60.0	22.0	25.0	1.0
Goose	60.0	21.0	30.0	1.5

It will be seen from the above that Duck and Goose are exceptionally rich in fat.

Eggs and poultry-meat form important articles of daily food among a large class of people in India. and poultry keeping is consequently increasing especially in places near towns. Some keep fowls for hobby, some for sport of cockfighting and some for profit. They can be reared for home use also.

Poultry are docile and easy to manage and can be looked after by women and children when the adults go out for work. It is, thus, within the scope of everybody and even a farmer with a small holding of land can keep a few fowls with advantage and extra income.

It has been calculated that a good hen when fed properly will eat about 5 annas worth of food in a month and will lay eggs worth about 10 to 12 annas. By keeping 30 hens one can earn a profit of about Rs. 10 a month or Rs. 120 a year with very little initial expense and trouble.

It is a distinct economy and advantage to keep fowls in a small way as a side line to general farming as the birds utilise enormous quantity of waste products, grains and vegetables from the farm; very often they eat insect pests and grubs or larvae and so assist to eradicate the pests which might damage the crops. In newly harvested fields the fowls will eat the shed grains, which would ordinarily be wasted. There is thus a saving in the cost of keeping fowls. Poultry dropping is very rich in

ammonia and phosphates and form an excellent manure for crops and the vegetable garden.

From an economic stand-point and stand-point of yield of eggs there are several breeds which lay large number of eggs as many as 200 to 250 in a year such as the leghorns, the light sussexes and Rhode-Island reds. Fish meal and shell grit given to fowls with grains fattens them and improves the size and quality of the eggs, the Ca salts in them improving the egg-shells so as not to be easily damaged during incubation.

VEGETABLE FOODS

A. Cereals

The staple food of nearly half of the Indian population is rice. In the Punjab, U. P., Oudh, Behar, C. P. and Gujerat in the North and in Madras Presidency in the South, the poor classes live on millet and gram and the richer classes adopt wheat or rice. In Bengal and Orissa rice forms the principle food and grows unsown in the Sunderbans, delta of the Ganges. In Mysore and the West Coast rice and ragi are commonly used and wheat to a less extent. In the colder regions of India, the Frontier Provinces and Baluchistan, maize is generally eaten with rice.

Cereals are so named from Cereus, the God of Harvest, doing six months' work and six months' sleep. Botanists classify cereals under "grass" but man uses only the grain, and the grain of grasses forms a complete fruit and seed.

The various food ingredients, viz., Proteins, Fats, Carbohydrates generally as starch, mineral salts and vitamins and even water are all fairly represented in the cereal grains, but Carbohydrates preponderate, so that cereals form the staple article of man's food all over the world except in the Arctic regions, where plant life is not possible from extreme of cold.

The chief Carbohydrate contained in cereal is starch which makes up to 65—70 p. c., and small quantities of sugar are also met with, but cellulose is not abundant except in their outer covering. Hence cereals are more easily digestible,

The great preponderance of Carbohydrates in cereals and their comparative deficiency in fats and proteins and vitamins indicates that cereals should always be eaten with other foods richer in fats and proteins like milk and eggs, and substances like bread should be eaten with butter or cheese.

The proteins vary considerably in kind in different cereals and their value as true proteins varies also. They average about 10—12 per cent.

The proportion of fats varies in different members of the group and it is interesting to note that those cereals, such as oats growing in the colder climates of northerly latitudes are richer in fats than the cereals of tropical growth like the rice, so much so fat is almost absent from rice. In this respect the cereals seem to be governed by the same Natural Law which, as we said, provides a milk supply specially rich in fat to the young whale or the young walrus of the Artic regions, so that the young cereal also, which has to grow up in cold climate, may be supplied with an abundant store of fat.

In addition to oats, Bajra or Cambu, millets and Ragi contain a fair percentage of fats; but they contain a lot of fibrous matter also in addition.

In respect of minerals like Ca, P and Fe all cereals contain a fair percent (2 p. c.). In this respect cereals resemble animal foods; thus ragi, bajra, wheatbran and oats contain a large quantity of Ca and P, while Fe is most abundant in wheatbran, bajra, rice, cholam, ragi and oatmeal.

Most of the cereals contain vitamins. Vit. A is present in bajra, wheat, cholam, ragi and yellow maize, while rice is the poorest in the matter of vit. A.

Vit. B_1 occurs in oats, wheat, millets, bajra and parboiled rice.

Vit. B_2 is contained to a certain extent only in whole wheat. As a rule whole grains are rich in vit B_1, while milled grains lose nearly all of them; the only exception is parboiled milled rice in which vit. B_1 is retained after milling.

Vit. C is present in large quantity in tender maize; and vit. D is absent altogether in cereals; vit. E is present in yellow

maize and rice. Refined wheat flour (American or white flour) is nearly all Carbohydrate and contain a small amount of Proteins, but in the matter of minerals it is extremely deficient and is entirely devoid of vitamins

The `proportion of water contained in cereals is about 10—12 p. c. even in the dry grains, that is, the same percentage as of proteins.

All cereals are rather deficient in building material except oats, and none of the cereals can be regarded as an important source of fat. As a group they are extremely **well absorbed** in which respect they rank next to animal foods or in some cases even above them. This fact combined with their compactness and richness in nutrients places them in the front rank of man's foods.

It must be noted that cereal plants or "grass" makes an excellent fodder for cattle containing in their green state a lot of vit. A B and C in addition to carbonaceous and nitrogenous matter.

To recapitulate: 1. Cereals provide large percentage of the total energy of the diet at comparatively little cost and have therefore, become the foundation of dietary all over the world. 2. Their proteins are however, not quite suitable ones, i. e. they are deficient in amino-acids; these amino-acid deficiencies have to be made up by the suitable proteins of milk meat or eggs or by the use of a variety of grains which are mutually supplementary as regards their amino-acids. We have seen already how the deficiencies of wheat, rice, ragi diets have to be made up by the addition of milk, eggs meat and dhal. 3. Highly milled cereals such as wheat or rice are very deficient in vit. B_2 and salts of Ca P and Fe, and perhaps vit. B_2 is the only vitamin contained in the pericaep and germ of the cereals, which ere lost in milling; cereals contain no other vitamins, but when they germinate their sprouts are a potent source of vit. C.

1. Rice *(Oryza Sativa)*

Rice is the most important cereal crop and is extensively grown in the Tropical and subtropical countries, where there is

sufficient water supply also; the acreage of rice cultivation in India is very vast being over a hundred millions.

Rice as harvested is known as paddy, in which the rice grain is enclosed in a tough husk; the husk is non-edible and indigestible being made up of cellulose and silica; and has to be removed before the rice could be used as food. As paddy the grains are well protected against external influences like moisture, weevils etc. and if the paddy is stored in a dry place it can be kept for an indefinite time without deterioration; but even as paddy it is necessary to observe proper precautions against damage by the damp weather.

The removal of husk is essential and is done either by hand-pounding or milling; in either process a part or all of the outer tough layer of the rice grain (silver skin) is removed with the husk. This outer layer called the bran—that is separated contains the germ or the embryo of the rice also, a larger proportion of proteins, fat and P, Ca, Fe salts, and vit. B_1 than the inner layer of the grain, (the grain proper) which is mostly (77 p. c.) starch; so that if the process of milling is carried to excess the rice loses a greater part of its nutritive properties. Over milled polished rice loses in this way a much larger part of its nutrition than hand-pounded rice.

The bran is edible and is rich in proteins, fats, mineral salts and vitamins, all of which are essential, we have seen, in the formation of a well-balanced diet. But it is not generally used for human consumption but only for feeding cattle and fowl. The germ is also rich in valuable food-constituents but is lost by milling.

The Protein of rice is very nutritious and is said to be superior to that of wheat. (See remarks under "Defects in Rice diet"—*Page 130*).

The composition of rice varies considerably with the kind of rice. The following is the average composition of the kind of rice in common use in India and clearly points out the loss effected by over-milling:—

	Moisture p. c	Proteins p. c.	Fat p. c.	Carbohydrates (Starch) p. c.	Ca p. c.	P p. c.	Fe p. c.	Vit. B_1 Units per 100 grammes	Vit. A and Vit. C
1. Rice (Raw and Home Pounded)	12.19	8.49	.35	78.27	·007	.165	2.2	100 units	...
2. ,, Parboiled ,,	12.63	8.50	.39	77.62	.010	.277	2.75	100	...
3. ,, Raw-Milled	12.96	6.85	.55	79.14	.007	.108	1.7	26	...
4. ,, Parboiled-Milled	13.29	6.44	.64	78.86	.007	.149	2.2	100	...
5. ,, White-Puttu	12.97	7.57	.37	78.75	·008	.084	3.3	100	...
6. ,, Black-Puttu	12.26	7.69	1.27	76.88	·012	.241	4.93	100	...

(After Aykroid.)

From the above figures it is clear that parboiled home pounded rice is the most nutritious, and highly milled raw rice is the least so.

Whatever the kind of rice employed the best method of cooking rice is and should be by "steaming," as in the common practice most of the salts, proteins and carbohydrates are lost in the gruel.

The chief methods of preparing the rice, then, are:

(1) Milling—The paddy is passed through a series of milling processes without preliminary soaking in water or steaming; in so milling a considerable part of the outercoat including the embryo is removed; and finally the grain is polished further by machinery to give it a smooth and white glistening appearance and to improve its keeping qualities. This is the polished, white or over-milled rice, known also as the Rangoon Rice.

(2) Parboiling followed by milling or hand-pounding: After a preliminary soaking of the paddy in cold water it is steamed or boiled, it is then dried in the sun and treated mechanically by domestic hand pounding or milled, by which the husk and part of the outerlayers of the rice grain are removed. This rice is parboiled rice or "red" rice.

Red rice differs from Rangoon rice in that the grain has been partly sterilised by heat and that less of the outercoat and of the embryo have been removed from it, so that the grain (red rice) is richer in proteins, fats, Ca, P and Fe salts and vit. B than the white rice. (See Table.)

Nevertheless it is the prevailing fashion to go in for the nice-looking pearly white milled rice in preference to the coloured but more nutritious and more sustaining hand pounded rice. Man is a blind follower of fashion and does not consider that colour and beauty are after all skin-deep; and so it is in the case of rice, white American flour and also in the case of refined white sugar, which, as we have seen, are much lesser articles of diet than their crude forms.

Parboiled rice is more easily liable to attacks by weevils and has a greater tendency to grow musty than the overmilled white rice unless it is properly stored.

Parboiled rice takes longer time for digestion than the white rice. This gives the poor labourer a better sense of fulness and satiety than the white milled raw rice. Rice after manufacture is liable to certain changes especially when stored in a damp place and becomes acted by microbes and ferments, which as a rule do no harm, but on the other hand improve its digestibility and taste, perhaps by partial conversion of the starch into sugar. Under certain conditions, however, harmful microbes may get access to the rice giving rise to formation of certain poisons without much change in the naked eye characters of the grain.

It is, therefore, necessary to avoid the mistake of calling two samples of rice as "being the same" merely because they have come from the same source or they are of the same kind.

2. Bajra or Cambu *(Pennisetum Typhoideum)*

Also known as Bulrush millet; is cultivated as a rainy season crop in N. W. F. Provinces, Bihar, Bombay and South India; is the staple food of the poorer. It is supposed to be heating, hence used mostly in winter. Unhusked grains contain Protein 12 p. c.; Fat 5 p. c.; Carbohydrates 70 p. c., salts of Fe, Ca and P and vit. A and B_1.

3. Barley *(Hordeolum Sativae or H. Vulgare)*

The Six Sided variety is usually grown in India, in the N. W. F., the Punjab, Ajmir, Merwara and Bombay. As prepared for food in India Barley is considered rather difficult to digest. Contains roughly, Proteins 10 p. c., Carbohydrates 60 p. c., Fat 2.0 p. c., moderate amount of minerals and vit. A (trace) and vit. B, (moderately). Barley occupies the place of pride among the cereals as raw material **par excellence** for malting both in the brewing and the food industries.

4. Cholam *(Sorgham Vulgare)*

Extensively cultivated as hot weather crop, common food of labouring classes, easily digestible, less wholesome than maize. Contains Protein 11 p. c., Carbohydrates 74 p. c., Fat 4.5 p. c.,

Fe and mineral salts in pretty good quantity and vit. A while green. Good malt can be prepared from cholam.

5. Italian Millet (*Setaria Italica*) (*Thennai Cholam*)

Is generally cultivated in the plains of Patna, Saran, Dinajpur etc; considered nutritious and digestible; composition similar to that of Indian Millet.

6. Indian Millet (*Panicum Miliaceum*) —*Panivaragu, Varagu*

Largely grown in many parts of India. Its composition: Protein 10.6 p. c., Starch 60.2 p. c., Fat 3.9 p. c. Fe Salts good quantity—no vitamins.

(*Panicum Miliare*)—Known as Samai—is another variety and has the same composition as the Indian or Italian millets.

7. Maize (*Zea Mays*)

Makke Cholam, Indian Corn—(It is called Indian Corn as it was originally obtained from Mexico, where the corn was extensively cultivated by the American Indians). It is cultivated in many parts of India and is the staple food of the peasantry in the Punjab, N. W, F. Provinces, Benares, Patna etc. Maize contains Proteins 9 to 10 p. c., Carbohydrates 60—70 p. c., Fats 4 to 5 p. c. Yellow maize is moderately rich in vit. A and B_1. It is considered not so wholesome as wheat. Maize is usually eaten fried or is ground and made into chappathis.

Cornflour is prepared from maize and refined.

8. Oats (*Avena Sativa*)

Cultivated in some parts of India; it is an almost perfectly adjusted food so far as chemical composition and ratio of nutrients are concerned. Contains Proteins 13.5 p c., Carbohydrates 63 p. c., Fat 7. 6 p. c , minerals good quantity and vit. B_1. It is regarded as the most nutritious of all cereals being rich in Protein and mineral matter and peculiarly rich in fat, the only other cereal which can at all compare with oats in respect of fat being maize. The proteins of oats are "complete" proteins and

therefore available for tissue-building as judged by their amino-acid make-up. The husk of the oats being closely adherent to the kernel cannot be entirely separated so that by the ordinary methods of grinding a good deal of cellulose is left in the meal; this cellulose acts as a stimulant to the bowels and makes oats a valuable diet in cases of chronic constipation with piles especially.

Oatmeal porridge is easily digested and is easily absorbed leaving comparatively little residue.

Quaker Oats and Rolled Oats are whole oats fried and crushed, by which part of the starch becomes converted into dextrin.

9. Ragi (*Eleusine Coracana*)

There are several cultivating varieties, of which Eleusine Stricta is often surprisingly productive. It forms the staple food of a large population of India especially the poorer and labouring classes and is the premier crop of the Mysore State and neighbouring Districts; and is perhaps the cheapest foodgrain on the market with a traditional reputation as a nutritious and sustaining food. Feeding experiments have shown that animals maintained exclusively on a diet of ragi showed considerable increase in weight; but it is somewhat slow of digestion on account of the rough husk, which has a laxative effect. Contains a phosphorus-containing protein 8 p. c., Carbohydrates 76 p. c., Fat 1.3 p. c. and large quantity of minerals and vit. A and B_1. Ragi contains a prolamin of high biological value, and on germination produces a highly active diastase, more potent than that obtained from cholam. Ragi can therefore be used for the manufacture of Malt. Ragi malt has an extremely agreeable aroma, yields about 74 p.c. extract and possesses good keeping qualities.

Ragi is employed in Africa for preparing a fermented liqour similar to beer.

10. Kootu or Buckwheat (*Fagopyrum Esculentum*)

Used by the poor classes in Northern India. Its composition is Proteins (15.2 p.c.), Fats (3.5 p.c.) Carbohydrates (63.6p.c.)

minerals and vit. B1 in good quantity. About 6 varieties are grown in India, their composition does not differ much from that of the millets.

11. Wheat (*Triticum Vulgare*)

There are about 12 varieties grown in India, extensively cultivated in N. India up to the Gangetic Delta, in S. India, the whole of the tableland above the Ghats and in the Himalayas and Tibet; is a staple article of food where rice is not common. It is the best of all the diets used by the Indian races if taken as whole-wheat flour (Atta). The chemical composition varies a good deal, the average being:

Proteins,	12 p. c.
Carbohydrates,	53 to 70 p. c.
Fats,	2.0 p. c.
Salts —	Fair amount.
Vit. A, B_1 & B_2	Fair amount.

(Wheat is used in 3 different forms: Suji, maida and atta. Wholemeal wheat flour is "atta," and the white wheatflour is "maida").

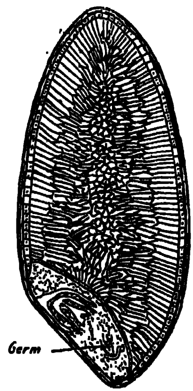

Fig. 3
Section of wheat x 60

If a grain of wheat is cut into thin slices and examined under the microscope it is found to consist of the following parts: (*Fig. 3*).

(1) The germ or the embryo—which is the beginning of the future plant and forms about 2 p. c. of the entire wheat grain.

(2) The endosperm or the Kernel—This consists of large masses of nutritive material (gluten) for the use of the embryo and makes up about 84 p. c. of the entire grain.

(3) The bran—an outer protective covering of the grain formed of cellulose impregnated with a good amount of mineral salts; about 14 p.c. of the entire grain is **bran**.

Each of these parts of the grain contains all the ingredients of the entire grain; but the germ is characterised by its **richness** in Proteins, Fat and vit. E (especially contained in

wheat-germ oil); the endosperm is characterised by an abundance of starch, and the bran by a preponderance of mineral matter and cellulose.

It must be mentioned here that both the proteins and Carbohydrates contained in the wheat grain are **chiefly present in a soluble form.**

In rejecting the germ and the bran, the miller undoubtedly discards some of the most useful chemical constituents of the wheat, such as proteins, fats and vitamins contained in the germ, and mineral matter, proteins and vitamins from the bran. Hence refined white wheat flour (maida) is mostly Carbohydrates and is devoid of portion of Proteins and fats and nearly all minerals and vitamins of the whole meal flour (*Atta*).

Bread

In making Bread the wheaten flour is kneaded into a "dough" with water, which is left-exposed to air. Yeast cells normally present in the air find their way into it and start to grow rapidly and multiply (the dough being a nutrient medium for their growth) and produce fermentation resulting in CO_2 and alcohol; other minute bacteria get into the dough at the same time, and these produce sourness (acetic acid, lactic acid etc.) so that the dough not only ferments but becomes sour. It was this fermenting dough that was originally used for making bread and was known as "leaven;" a little of this leaven was added to the first dough and the yeast which it contained started to grow through this fresh dough till the entire mass was leavened and filled with bubbles of CO_2. This leavened dough was then baked, part of it being kept over to be used for the fermentation of the dough of the next batch of bread.

Now, the making of bread is possible only with wheat and no other cereals as wheat only contains "gluten," a protein which has the peculiar property of becoming viscid and gummy when mixed with water, and when CO_2 is formed in the dough as a result of fermentation the bubbles cause the dough to become cellular when baked; the cells no longer collapsing the bread is rendered spongy.

As this process causes bread to become sour it is now given up and the next advance on this process which might have been introduced after brewing of Beer became known, was to use pure Brewer's yeast. This produced good bread without the sour taste. Several modifications have, however, of late been made, all with the idea of producing sponginess of the loaf. Good bread should be white in colour and light and spongy; a yellow colour or an acrid taste indicates old flour or bad yeast; a heavy bread is indicative of insufficient baking or bad yeast and is indigestible.

Beemax—an artificial form of Food—is prepared from the embryos of cereals and is said to be rich in vit. A, B and E and is rich in Proteins, Phosphorus and contains 43 p. c. of Carbohydrates.

B. Pulses

Pulses are seeds of leguminous plants and include peas, beans, grams and lentils. The chief chemical characteristics of this group are their richness in Nitrogen. There is a special provision made by Nature for the adequate supply of N to leguminous plants in general in the form of little nodules on their roots, these nodules consist of bacteria which have the power of fixing the free N of the air and passing it on to the use of the plant.

Most of the Nitrogen present is in the form of protein, and in virtue of this fact pulses have been described as the "poor man's beef," and for this reason black gram is probably named "masha" in Sanskrit.

1. The chief protein food in the pulses is "legumin," sometimes spoken of as the vegetable casein, owing to its resemblance to the chief protein (casein) of milk; so much so that a kind of cheese is being prepared from beans.

Pulses do not readily soften if the water in which they are soaked is **hard**, i e. if it contains much of lime. The addition of Bicarbonate of soda to the water, however, throws down the lime and a brief soaking in water thus treated enables the pulses to be soaked sooner and baked more readily; the alkali also removes

part of the bitter principles present in some varieties of the dry grains.

2. All pulse-proteins contain sulphur but less than the protein of meat. Beans are richer in sulphur than peas, while lentils contain the least of all; they also contain Ca salts as much as milk or Brown bread, Phosphorus as much as is present in whole meal flour, and as much Fe as in yolk of egg; in other words pulses rank high in the yield of mineral constituents.

Pulses, therefore, differ from the cereals in that they contain a higher percentage of Proteins and mineral salts; some of them contain more fat, e. g. soya beans contain 25 p. c. and groundnut about 50 p. c.

3. Carbohydrates contained in pulses are abundant, but most of the pulses are poor in respect of fat with the exception of soya beans and the groundnut as noted above. Hence the pulses go well only with fatty foods.

4. Almost all the pulses do contain varying amount of vit. A, B_1 and B_2 but not vit. C; but sprouted pulses do contain lot of vit. C.

5. Pulses are **not readily** digested by the stomach, no doubt partly owing to their bulkiness on cooking, but if properly prepared they are absorbed in the intestines very thoroughly. Experiments have proved that the proteins of pulses are capable of thorough absorption if given in a state of fine division and are more thoroughly absorbed than gluten, the protein of white bread.

We have seen that the nutritive value of the pulses is undoubtedly high, especially is this the case regarding proteins. But supposing an active adult male undertakes to live on pulses alone, say peaflour, it would require about 22 oz. of peaflour to supply him with the necessary amount of protein required for his daily needs; but this amount of flour would hardly contain the necessary amount of carbohydrates required and would be very deficient in fat also. These deficiencies (of carbohydrate and fat) have, therefore, to be made good either by the addition of some other articles of diet or by increasing the amount of peaflour consumed. As a matter of fact it has been found that when the quantity of peaflour eaten amounts to about 36 oz. for the 24

hours all the demands of nutrition are satisfied. But the question is if anyone can go on consuming such a quantity for any length of time. It comes then to this: that while the pulses are most valuable sources of Protein, they are not adapted to be the exclusive diet for purposes of health. As a cheap and suitable means of supplementing the deficiencies of Nitrogen in a purely vegetarian diet, however, their use is strongly advised; and it is a pity that they are not more largely taken advantage of by people as a means of saving money also, for unquestionably the **pulses are amongst the cheapest of foodstuffs with the maximum amount of nutrition.**

The husk of pulses is a good feed for cattle improving the quantity and quality of the yield of milk, as the husk contains valuable mineral salts and a fair amount of nitrogenous matter.

1. Bengal Gram (*Cicer Arietinum*) *Chana*—ಕಡಲೆ

Contains about 18 p. c. proteins,
5.5 ,, fats,
and 10 ,, salts, of which 9.8 p.c. is formed by Fe.

Vit. A, B_1 and B_2 are also contained in the gram. But roasted Bengal gram is devoid of all these vitamins. Vit C is however, absent in all pulses in general as noted already except when they are **sprouted**, in which case their vit. C value is considerably increased.

Kesaridhal is the split Bengal gram, is more nutritious than the whole gram but entirely deprived of the vitamins of the whole gram.

2. Black-Gram (*Phaseolus Radiata*) ಉದ್ದು

Is the "masha" mentioned above and is an excellent nutritional equivalent of meat in respect of amount of Proteins, their digestibility and their absorption. Black gram is rich in Fe and vitamins.

3. Cow Gram (*Vigna Catiang*)
(ಅಲಸಂದೆ ಬೀಜ, ಕರಮಣಿ ಪಯರ್, ತಡ್ಡಿಗಣಿ)

Contains more protein than either Bengal gram or Black gram but less of mineral salts.

4. Field Beans (*Dolichos Lablab*)

(ಹಿಂಗವರೆ) *Mochhai Kottai*—Tamil

The green pods and seeds (green or dry) are used as vegetables; they contain Protein 17.1 p. c., Carbohydrates 57.4 p. c., and Fat 2 p. c. and are absolutely devoid of vitamins except of course when the grains are sprouted.

5. Green Gram (*Phaseolus Mungo*) ಪಚ್ಚೆ ಹೆಸರು

Mungo contains 24 p. c. Proteins, 1.26 p. c. Fat and 56.69 p. c. Carbohydrates, a large amount of Fe and Ca salts and fair quantity of vit. A, B_1 and B_2. Vit. C is abundant only in the sprouted grain, which forms an important element of diet among the orthodox Hindus to break their *Yekadasi* fast the next day. Green gram is an excellent laxative and diuretic and is a bland soothing diet in piles, especially when inflamed.

6. Horse Gram ((*Dolichos Biflorus*) (*Kulti*)

It is a nutritious food for the poor, but being difficult of digestion is better borne if taken as meal or flour after dry frying. The gravy of the baked grains as given to horses is very nutritious and has an inviting flavour, and when seasoned with garlic or asafetida forms an appetising soup before a large meal and can be served with butter or ghee.

7. Lentils (*Lens Esculenta*) ಅಲಸಂದೆಬೀಜ

Is the most nutritious of the pulses with the exception of soya beans, having in it a large proportion of Proteins, Carbohydrates and Vitamins A, B_1 and B_2, but poor in the matter of fat and mineral salts and sulphur, although it is fairly rich in Fe. Lentils are more easily digestible than either peas or beans and are less apt to cause flatulence also.

8. Peas (*Garden Peas*) (*Pisum Sativam*) *Battani*

Is eaten either green and baked, or dried, baked and roasted. Green peas cooked in the usual manner contain only 16 p. c. carbohydrates of which a considerable proportion is sugar.

9. **Red Gram** *(Cajanus Indicus) Togari*

Is commonly made into Dhal and forms a useful supplement to Rice Diet. It contains a fair proportion of proteins, a good percentage of Iron and vit. A B_1 and B_2. A black variety is commonly grown in Malabar and is a highly flavoured pulse especially while tender.

10. **Soya Beans** *(Glycine Hispida)*

Soya beans resemble in appearance dried peas, but when soaked in water they elongate and look like lentils. It is the richest of all the pulses in Proteins (43 p. c.), has also a large amount of fat (20 p. c.), but very little starch (21 p. c.), a large amount of mineral salts especially Fe (11.5 p. c.) P and Ca. Regarding the vitamin contents it surpasses all pulses and cereals, vit. A B_1 and B_2 being abundantly present even in the dry grain.

By reason of low starch content soya beans are of use as a substitute for bread in Diabetes; a flour being prepared from it and made into loaves or biscuits. As pure soya flour has a bitterish taste, which may be an objection perhaps in the case of some people, it is mixed with an equal quantity of wheat flour before being used as food.

In China and Japan it is extensively eaten in the form of soya cheese, and as various sauces and pastes; all of which are rich in proteins and fats and are best fitted to supplement the deficiencies of their rice diet.

It is also grown in India and does not require much of care and promises to be a cheap but very nutritious article of food for the poor and rich alike.

A synthetic product, soya milk or solac, has been prepared and closely resembles cow's milk and is able to replace cow's milk to a large extent for many purposes.

The fried-beans powdered are exactly like coffee in colour, taste and flavour and is an efficient substitute for coffee but much more nutritious and non—stimulating.

11. **Peanut** (*Groundnut, Arachis Hypogea*) ನೆಲಗಡಲೆ.

Although botanically one of the pulses, peanut really resembles more closely the true nuts. Like the nuts it is rich in proteins and fat and may be used roasted as a diabetic food. It contains 26.72 p. c. proteins, 40.13 p. c. fat, 21.0 Carbohydrates and vit. A, B_1 and B_2. Groundnut on expression yields a bland edible oil, which is also used for industrial purposes and for production of soap. Groundnut cake forms excellent food for cattle and rich manure for plants.

A patent food—nutrose—is mostly groundnut deprived of part of its oil.

12. Beans

There are several varieties of these which are used as food.

1. The French kidney bean, or pink bean (Phaseolus vulgaris)—The tender pods with the seeds or the seeds alone are consumed, either green or dry, of course stewed. The amount of cellulose present in the pods causes it to be digested and absorbed with difficulty and on that account it is a wasteful form of food.

2. Allied to the French bean are the scarlet runner beans (Phaseolus multiflorus) which are used stewed.

3. The Broad Windsor beans, or Double beans (Faba vulgaris) are eaten either in the green or dry state.

Beans are, on the whole, richer in protein than peas but contain also more sulphur and are more apt to cause flatulence.

All beans contain vit. C, and cluster-beans (cyamopsis psoralioides) contain vit. A also; while French beans contain vit. A and B_1 also.

4. The Indian mitki (Kottavaranga—കൊത്തവര) (cyamopsis Tetragonoloba) is also a variety of beans, the entire pod with the seeds only being used cooked. The pods are very indigestible from the presence of a large amount of fibre and starch; that is the reason why it does not agree with many being said to cause biliousness.

5. Sword-beans (Canavalia Ensiformis) —Val-avaranga—

Tammattangai - are large variety of beans. The seeds and the pods are sweet and mealy when cooked. They are heavy bearers and easily cultivated, and are extensively grown in jail and asylum gardens in South India.

6. Butter beans—(Phaseolus Lunatus).

* * * * *

Comparative biological value of gram-proteins:

"Bengal gram, black gram and green gram are found to be superior to lentils; green gram is much superior to lentils in other respects as well, viz. with regard to available protein content and the power of supporting growth. Further, green gram forms much better supplementary relations with rice than lentils. Thus the practice of giving lentil soup during convalescence of an invalid should be replaced by that of green gram."

C. Roots and Tubers

While the chief bulk of the grains of cereals should be regarded as a store house of nutriment for the young plant, the roots and tubers may be regarded in like manner as reserves of nutriment for the use of the adult plant itself; the reserve nutriment so laid up is almost entirely in the form of Carbohydrates – chiefly starch; proteinsa nd fats are much scarce in them. Hence roots and tubers are the chief source of only one of the nutritive elements of food, viz. Starch; and this fact should not be lost sight of in estimating the value of this class of vegetable food. They are, however, by no means destitute of mineral ingredients, mainly salts of Potash, and the presence of these confers upon them (roots and tubers) a greater value as articles of diet than they would otherwise be entitled to possess.

All of them except beetroot and tapioca contain vit. A, especially Carrots and Elephant Yams; vit. B_1 is contained in beetroot, carrots, parsnips, potatoes, radish and ordinary yam; while vit.B_2 is present only in potato, sweet potato, Elephant Yams and colocasia; vit. C is present in almost all of them except colocasia and the yams, in which it is present only in trace—and in tapioca it is entirely absent; in fact no vitamins have been detected in tapioca.

The antiscorbutic value of potatoes has been known as far back as 1781, and Blane alluded to the beneficial action of the potato in scurvy among the fleet, and Dr. Baly remarked in his enquiries with the diseases of prisoners that wherever potato was used scurvy was unknown. We have already referred above to the outbreak of scurvy following the great potato famine in Ireland.

One important general consideration that has to be borne in mind is that the mere cooking of these foods robs them of a large quantity of mineral salts present in them and also some of the nitrogenous elements in which they are already so deficient. For this reason the water in which they are cooked should not be wasted but should be utilised as far as possible, or, which is more preferable, they should all be cooked by **steam** and **with their skins intact.**

As regards the digestibility of this class of food in general it may be said that it mainly depends upon the amount of cellulose which each of them happens to contain; but it is true that they are only indifferently absorbed and are prone from their bulk to derange the stomach and bowels if eaten in large quantity.

1. Potato *(Solanum Tuberosum)*

Potato is "the world's greatest plant" and is one of the most widely cultivated crops in the west. It is used for food for man and animals and for the manufacture of starch and industrial alcohol. Potato is grown all over the world.

It is said that potato was first discovered by the Spaniards in the neighbourhood of Quito in Equador, where it was under cultivation early in the 16th Century. It was also found in Peru and Mexico and was known as "papas." The explorers carried it to Spain in 1535 after the conquest of Peru, and it is said a Monk, Cardan was the first to introduce it from Peru into Spain. It was introduced into England in 1586 by Sir Francis Drake. and now forms an important staple article of food of many nations.

If the potato is cut across with a sharp knife three distinct layers can be made out with the naked eye;

(1) The thin outer skin or rind.

(2) A broader layer inside the skin, called the fibro vascular layer, forming about 10 p c. of the total bulk.

(3) The flesh of the potato, forming about 89 p. c. of the total bulk of the potato.

The fibro vascular layer being considerably richer in mineral matter and protein than the flesh of the potato, if the rind is peeled off in the raw state, a portion of the fibro-vascular layer also comes off with the rind, which means that we lose those valuable ingredients to a large extent.

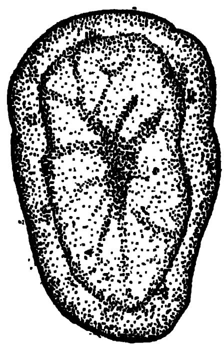

Fig. 4. Potato

The "flesh" of the potato consists mostly of starch and nitrogenous elements and salts in solution in its juice. It must be realised that by no means all of this nitrogenous matter is present in the form of Proteins; in fact the protein-content of potato is very low, and most of the nitrogenous matter is present as "asparagine" which has no nutritive nor tissue-building properties. One is, therefore, apt to greatly over-rate the value of potatoes as tissue-building food.

The richness of potato in starch is its most striking chemical characteristic and causes it to be one of the chief commercial sources of starch and dextrin.

The starch grain of Potato is of specially large size, but unless cooked is not easily digested and absorbed and causes flatulence. Owing to their readiness to undergo fermentation potatoes do not form good food for the dyspeptic.

The most important mineral ingredients of Potatoes are salts of Potash, Calcium and Phosphorus, and potatoes are one of the chief sources from which we obtain our supply of these salts. Potatoes provide a large amount of vit. C; they also yield more vit. B and Iron than milled cereals.

Potatoes like all tubers may have their composition and

consequently their nutritive value considerably modified by the mode in which they are cooked: If they are peeled and soaked before being boiled a large part of their nutrients (Proteins and mineral matter) will be lost, and it is for this reason that potatoes should either be steamed or cooked in their skins.

The digestibility of potatoes depends largely upon the form in which they are **eaten,** being less digestible when eaten as lumps; "mealy" potatoes are more easily digestible than "waxy" potatoes.

The absorption of boiled potatoes in the intestines, however, is almost **to the last grain** as they contain much starch and little cellulose, yet they are **not suited to constitute the staple diet** of man,they are much too bulky and contain too little protein in proportion to their starch; and if one should live on potatoes alone about 6 lbs. of them may be required by him for his daily requirements of energy.

This quantity is unduly bulky, weighing as it does about 3 times as much as an ordinary mixed diet. The result of the continued use of such diet will be undue burdening of the stomach and bowels, producing dyspepsia, dilatation of the stomach and diarrhoea. The so called ' potato-belly" of the Irish peasant is an example of such a result.

As an article of diet potato is recommended to replace part of the sugars and highly milled cereals in a diet.

2. Sweet Potato (*Ipomoea Batatas*)

Is a product of the tropics and is a common food of the poor. In the matter of nutrition it equals potato but richer in the matter of starch and vit. C, It was discovered with Potato by the Spaniards in Brazil and introduced into Spain in 1519. The natives of Brazil called it "batatas" corrupted into potato. The Potatoes mentioned by Shakespeare in the 'Merry Wives of Windsor' are really the sweet potatoes.

3. Yam, Elephant Yam, ಸುವರ್ಣ

(*Amorphophallus Campanulatus*)

Is more or less allied to potato in its chemical composition,

but contains much more vit. A and is more deficient in vit. B, than potato.

4. **Common Yam** (*Typhonium Trilobatum*)

Is the tuber of a tropical climbing plant, is much larger than the potato but similar to it in taste and chemical composition, but the vitaminous value of ordinary yam is much less than that of either the elephant yam or even the potato.

The nutritive value of yams is the same as of the potato, but some of them have an alkaline principle, which causes irritation or itching of the mouth and skin in the raw state and some of them even on cooking. This principle can be neutralised by the addition during cooking of any acid stuff, such as tamarind, green mango, limes, Chinese gooseberries, Hogplums (*ambadaikai*) Kamambola and Indian sorrel (*gonghur, Pulichan-keerai*).

5. **Kurukkoo** (*Coleus Parviflorus*)

One variety of edible tubers allied to potatoes extensively cultivated on the west coast is the Kurukkoo (ಸಾಮ್ರಾಣಿ ಗಡ್ಡೆ) (coleus Parviflorus). The cooked tubers have an aromatic flavour, are sweetish in taste and excite the flow of saliva; on this account they are perhaps as easily digested and as completely absorbed as the potato. They do not give rise to flatulence and are good diuretics.

6. **Turnips** (*Brassica Rapa*)

Consists of 90.3 p.c. water, that is much more than what is contained in milk; yet it is difficult to realise that an apparently solid object like the turnip should really contain more water than a fluid like milk. Turnips contain very little protein and carbohydrate; the latter does not exceed even 5 p. c.; pectin and cellulose make up a large portion of the carbohydrate and the frame work of the turnip giving it the solid consistence. Turnips can never be regarded an important form of food, but they are used as condiments for their mustard—like flavour and pungent taste.

7. **Carrots** *(Daucus Carota)*

Are decidedly more nutritious than turnips mainly owing to their richness in sugar (cane sugar or fruit sugar) to the extent of about 10 p. c; the amount of protein contained is negligible but their mineral salts are of some value. They are also an admirable source of carotene from which the body can manufacture vit. A. Carrots are difficult of digestion and cannot be regarded as an absorbable foodstuff.

8. **Knollcoll** *(Brassica Oleracea-Caulo Rapa)*

Contains 6 p. c. starch and only traces of Proteins and salts and vit. C.

9. **Beetroot** *(Beta Vulgaris)*

Contains canesugar from 10—15 p. c. sometimes; like the carrot and turnip, beetroot is almost of no foodvalue as a source of Protein and contains a lot of indigestible cellulose; which, however, does not interfere with its digestion, as most of the Carbohydrate contained therein is in the form of sugar, which is readily absorbed into the system without previous digestion.

10. **Parsnips** *(Pastinaca Sativa)*

Parsnips are similar to carrots and are fairly rich in starch and sugar.

11. **Onions** *(Allium Cepa)* ನೀರುಳ್ಳಿ

Onions are chiefly valued for their pungent oil, which makes them useful flavouring agents. They are, therefore, regarded as condiments rather than food. The large white Spanish Onion and the large red Goa variety are however, sweeter and less pungent, but are richer in nutrients like available Carbohydrates than the smaller variety which contains more pungent oil.

Onions are powerful carminatives and valuable in cases of constipation probably from their richness in cellulose.

The volatile oils of onions and garlic (allium sativum) which

bring tears into eyes on cutting have been found to have germ killing powers which may be useful in fighting disease. These germ-killing and tear-starting chemicals were isolated for the first time by Vollrath and Lindegreen of California. The germ killer from onions is allyl aldehyde, that from garlic is the less poisonous crotonic aldehyde. Tests are now under way to determine the usefulness of these substances in healing infectious diseases due to germs. The fact that onions do not spoil readily and have remarkable resistance to bacterial attacks led to the present discovery.

An Italian Scientist, Gurwitch, first found out that root crops, and particularly onions emanated ultraviolet ray or M. Ray or Gurwitch ray. This ultraviolet ray is made available to biological specimens by the simple process of transferring the energy into water. Country onions about one inch in diameter are used for this purpose. The emanations continue 24 hours after removal from the earth. After washing the earth onions are placed with the roots intact in 100 times their volume of water in a glass or mud vessel, (which are bad conductors) without any metallic contact. The ultraviolet ray in the onion is gradually transferred to the water. This onionised water has certain peculiar properties which are utilised in agriculture. Seeds previously soaked in this water before sowing do germinate more readily and crops irrigated with water passing through a bed of onions do thrive very well.

Dr. Misra of U. P. who has made tests in this direction reports that a bed of 10 ft.×10 ft. with onions thereon is sufficient for irrigating one acre of land and that two such beds would facilitate their alternate use, thus giving time for the revival of energy for each bed on the day of rest. Such easy methods do not add to the cost of cultivation but easily increase the yield.

Dr. Misra has found that onion water charged with M. rays is medicinally useful in the treatment of renal and intestinal colic, constipation, sore eyes, sore throat, ulcers, burns etc. and also enlarged thyroid (Derbyshire neck) and bubonic plague.

12. Garlic *(Allium Sativum)* ಬೆಳ್ಳುಳ್ಳಿ

Garlic also is rather a condiment than food and contains the volatile oil noted above. It contains arsenic in minute quantity. An alcoholic tincture of garlic is useful in cases of intestinal and lung tuberculosis and as a local application to inflamed glands from any cause. Garlic is reputed to reduce **blood pressure** and is a tonic in chronic skin diseases.

13. Radishes (*Horse-Radish*) ಮುಲ್ಲಂಗಿ
(*Armoracia Radix;—Raphanus Sativus*)

Two varieties are common white and pink; both contain a large proportion of water (90—94 p. c.) and a small amount of Carbohydrates and a volatile oil giving them a pungent taste. Used in medicine as a Carminative and is a good laxative in cases of piles.

14. Colocasia *(Colocasia Antiquorum)*

(Shembu, Shepa kananga) consists of:

Proteins	3 p. c
Carbohydrate	22 p. c.
Fat	trace.
Fe	2.13 p. c.
Vit. A, B_2 and C	Small amount.

Most varieties contain a mucilaginous principle allied to pectin, and sometimes an alkaline substance which causes itching of the mouth on swallowing even when cooked. Such things have to be cooked peeled with acid stuff to get rid of this irritant.

The stem and leaves of colocasia are also used as green vegetables and have a nice laxative effect. Some varieties contain Fe also in the stems and leaves. It forms the chief vegetable in the diet of mothers soon after delivery, probably the vit. A has a beneficial effect in the prevention of puerperal septicaemia.

Colocasia leaves are used in the preparation of Patravadai, a baked form of sandwitches prepared with green gram or

Bengal gram and considered a delicacy. Colocasia stems and leaves of particular varieties are prescribed by Indian Vaids and Hakims in bleeding piles and some forms of skin disease.

The rhizome or root stem of some forms grows to an enormous size and are used as food, of course baked; they are, however, digested with difficulty and are apt to produce colicky pains and windiness from presence of a lot of fibre.

15. Tapioca (*Manihot Utilissima*)

(Maravalli Kananga). This plant belongs to the N. O. Euphorbiaciae (the same class as the castor plant). It is extensively grown in the waste lands in Malabar and Travancore and forms the staple diet of the poor, as we saw.

The roots contain about 40 p. c. starch with trace of protein and minerals and are entirely devoid of vitamins. Several varieties are known, but one of them, the most nutritious and most productive, economic and with little fibre is the "butter stick" variety, introduced from Poona; each plant bears at its root 4 to 8 long club shaped tubers varying in size from 12 to 18 inches in length. These when cooked become soft and mealy being fibreless and it is for this reason that it is named "butter stick" As an experimental measure this variety was once grown in the Mental Hospital, Calicut and yielded a good supply.

The cultivation of the plant is not difficult, the only consideration being a loamy and light soil; it can be cultivated on dry land at the beginning of the monsoon and does not require much of watering later and can be reaped in less than six months.

Commercial tapioca is derived from the roots of South American Cassava plants; curiously enough one of these—the bitter cassava—contains mixed up with the starch a milky juice in which is present a good deal of that dangerous poison, prussic or Hydrocyanic acid. The roots are grated and washed with water, the bitter principle is thus washed away, and the starch allowed to settle. It is then collected and dried. The percentage of starch present in commercial tapioca is about 87½.

Tapioca is difficult of digestion and cannot be borne by a weak stomach even as a porridge; but its absorption in the intestines is nearly complete being practically all starch.

16. Sago

Sago is obtained from the pith of the sago-palm, commercial sago contains 86.7 p. c. of starch and is therefore sometimes classed under cereals, so also arrowroot and tapioca.

17. Arrowroot

Arrowroot is obtained from the rhizome or root of a West Indian plant, Maranta Arundinacea. The roots are mashed up and washed with water (to get rid of the bitter principle contained therein) and the starch allowed to settle. When dried it constitutes the ordinary arrowroot powder and contains about 82.5 p. c. of starch and traces of protein and mineral matter.

The digestibility of arrowroot and its allies, sago and tapioca, in the stomach is much the same and their absorption in the intestines is exceedingly complete. This gives them a special value in diarrhoea.

As regards the nutritive value of all these preparations it must be said that they are all agreeable forms of starch, but being almost entirely Carbohydrate they should not be taken alone but along with substances rich in protein and fat, such as milk or eggs. Arrowroot or tapioca pudding prepared with milk and eggs, has long been in use even before anything was known of its Chemical Constituents.

A cupful of arrowroot conjee contains only half a teaspoonful of starch and as such does contain only a small amount of nutrition in it, but when milk is added to the arrowroot conjee its biological value is raised and the digestibility of the milk also increased; the mixture therefore, constitutes a wholesome and bland drink for those with a weak or irritable stomach as in dyspepsia and in diarrhoea.

18. Salep-Misri (*Sala Misri*)

This is a starchy preparation derived from the roots and tubers of various species of orchids and imported into India from

Smyrna. It is credited with fattening properties if taken boiled with milk and sugar every morning and is said to stimulate the sexual appetite. Being mucilaginous when boiled with water or milk it has perhaps the power to facilitate the digestion of milk as arrowroot or barley does and minimise tisssue-waste and thus of fattening the body.

D. Vegetables

The leaves of green vegetables are to be regarded as the lungs of the plant to which they belong and are merely the frame work on which their green coloring matter, Chlorophyll, (by which the plant feeds and breathes) is spread out. In no sense are the leaves, like the roots, store houses of nutriment to the plant. One would not expect, therefore, that such leaves would have high nutritive value, and chemical analysis entirely confirms this view.

Speaking generally it may be said that green vegetables contain: —

(1) A good deal of water.

(2) Almost no nitrogenous matter, even of what nitrogenous matter is present, only about half is in the form of Protein.

(3) Practically no fat.

(4) And only a small quantity of Carbohydrate, 2 to 8 p.c. This small proportion of Carbohydrates renders their use especially as **carriers** of **fat** admissible in diabetes.

(5) Their frame work contains a good deal of cellulose, which is of no food value to man.

(6) The amount of mineral salts and vit. A, B_2 and C which they contain is relatively large and confirs upon them much of what value they possess as foods.

Leaves are generally rich in Ca and Fe, the greener the leaves the richer they are in the food elements.

The effect of cooking on green vegetables is still futher, to reduce their already poor stock of nutrients; they gain in water, in some cases by even 10 p. c.; and lose part of the Carbohydrate and protein, much of their mineral matter and nearly the whole of their nonprotein nitrogenous matter in the gravy. The

deficiency of fat in vegetables is overcome by the addition of butter or oil in the course of the preparation for the table.

Vegetables, as a whole, are most easily digested in the stomach; cauli-flower, it is worth knowing, is much the most easily digested of all of them. In the intestines also, vegetables are difficult to deal with because of their bulk and amount of cellulose which they contain. Flatulence is thus apt to be produced.

Vegetables when stale are apt to ferment in the intestines. To be wholesome they should always be eaten as fresh as possible.

The absorption of the nutritive constituents of most vegetables is also rather defective. They constitute one of the few forms of food from which even starch is not completely absorbed

When one realises that green vegetables are poor in nutriments to start with, that they become still poorer on cooking and that even of the remnant which reaches the intestine a large part escapes absorption one can readily understand, considered as foods they are of very low nutritive value. Indeed, it may be said that green vegetables are only of use in diet for the following reasons:

(1) They supply 'ballast' to the intestines, the indigestible residue which they leave behind being a mechanical stimulus to the intestinal movements. Hence their special value in constipation, especially of the chronic type.

(2) They are a valuable source of mineral salts, especially compounds of Potash, which help in the maintenance of the alkalinity of the blood, and also in lowering the acidity of urine. The alkaline salts are also useful in some forms of skin disease, such as chronic Eczema; Clement Dukes points out that there were several epidemics of eczema resulting from a deficiency of green vegetables in the diet of school boys.

The free use of green vegetables is recommended for patients suffering from "gravel" also.

(3) Green vegetables are also valuable sources of Fe in the diet. Thus, amaranthus and cress, Fenugreek (మెంతె కూర), Indian sorrel (gongur), bitter gourd, cluster beans and peas,

drumsticks are fairly rich in Fe. The stems of amaranthus are often humourously named "ironbars" on account of the presence of Fe in them.

(4) Certain organic acids are present in green vegetables. Thus, sorrel, rhubarb and ginger contain oxalic acid, tomatoes and green mangoes contain citric and malic acids etc.

(5) Several vegetables contain **mucin**, a sort of gummy albuminous matter capable of sparing the protein tissues of the body and preventing body waste.

(6) Vitamins. Green vegetables are an important source of vit. A, B_2 and C, especially vit. C, to the presence of which their antiscorbutic value is mainly due; and there is no doubt that some of the benefits derived from their use in health are due to the presence of several vitamins.

Most vegetables can be used uncooked to retain the vitamins and should be well washed with clean water before eating. To retain their salts and proteins vegetables should be first well cleaned with water and then sliced, the cut pieces should never be washed but be directly steamed; if boiled the gravy should not be thrown off. Potatoes are therefore, best cooked entire and in their skins, and fruits stewed entire without being sliced.

Leafy Vegetables—Greens

Amaranthus—3 varieties are commonly used as vegetables.

1. Amaranthus Gangeticus—Tandukeerai (Tamil)
   Dantu (Telugu).
2. ,, Spinosa—Mullukeerai.
   Thottakkura; Kantanatza.
3. ,, Viridis—Kuppaikeerai, Chilakathota
   Koora—ಗೊಣ್ಣೆಬಾಜ

Gangeticus contains a lot of vit. A, B_1 B_2 and C and Fe and Ca salts.

Garden Cress (*Lipidium Sativum*) resembles amaranthus in respect of nutrients and mineral salts such as those of Fe but is deficient in vitamins except vit. B.

Fenugreek (*Trigonella foenum graceum*) Vendai-keerai;

methi bhaji—మెంతె కూర—contains a small amount of protein and Carbohydrate but a fair amount of Iron salts and a lot of vit. A. It has a bitterish taste and has the medicinal value of being good carminative and laxative acting by stimulating the liver.

"**Gogu**" (*Hibiscus Sabdariffa, or Cannabinus*) Rozelle hemp—Jelly plant—Indian sorrel—Pulichen keerai, Ambati bhaji, Sourcress—Is an edible variety of hemp.

The tender leaves are used extensively in the Circars in the form of chatni with salt and chillies and fried pulses. Contains oxalic acid and a fair proportion of Fe but no vitamins. It has nice laxative properties.

The ripe red pods of this hemp yield a juice, which when heated sets into a jelly and are therefore used to make jams.

"**Agathikeerai**" (*Sesbania grandiflora*)—Bak—Commonly used by Hindus to break the fast; contains a fair proportion of Fe and vitamins.

Spinach (*Spinacea oleracea*)—Basalakeerai—contains a small amount of albuminous matter in the form of mucin, fair amount of Fe and a large quantity of vit. A, B_1 and C.

Spinach is therefore a good laxative and demulcent, is capable of minimising tissue-waste and has considerable antixerotic, antiberiberi and antiscorbutic properties, especially when raw tendrils are eaten. Spinach is, therefore, superior in all respects to fresh potato juice and can be administered to children mixed with honey and sugar.

Luni (*Potulaca oleracea*) is a form of fine leaved cress known in Vernacular as Karicheera.

Chakvat Bhaji (*Chenopodium album*) Pappukoora in Telugu, is a common form of edible cress, having like amaranth great antiscorbutic, demulcent and laxative properties useful in piles and gonorrhoea. They are also rich in mineral salts, as of Potash and Iron and contain albuminous matter and other compounds of Nitrogen. They are all good sources of vit. C when used raw.

Coriander Leaves- (*Coriandrum Sativum*) కొత్తుంబరి సప్పు and *Karibevu* (*Murraya Koenigii*) are used more as condiments than greens and have an inviting flavour and are good appetisers.

They contain a large amount of vit. A, B_2 and C.

(The Tamil equivalent of Karibevu is Kari-vepa-alai or rather Curry-vepa-alai; the latter is said to be the proper derivation of the word).

Mint - (*Mentha Viridis*)-- Pudina -is a common condiment—contains a fair amount of Fe, and vit. A.

Kakke Sappu (*Solanum Nigram*)—Manithakkali. (Small varieties of tomatoes) in Tamil. The leaves of this plant and the leaves of drumsticks (moringa pterygosperma, winged seeded) are often used as greens either by themselves or mixed with sprouted grains. They have a high Iron content. Drum sticks leaves contain vit. A only, while manithakkali contains vit. C. Manithakkali leaves cooked as greens, and the dried fruits fried in ghee are a household remedy in Tamil Districts for chronic stomatitis and diarrhoea, the result of A-Vitaminosis.

Ekpani -Onthalai *Hydrocotyle Asiatica*— is often used as a condiment (like mint) by Hindus on the Dwadashi mornings.

Tender Bamboo Shoots -(*Bambusa Arundanacea*) are often used as food. They have no food value whatsoever and have an acrid alkaline principle, which is got rid of either by soaking the slices in water for 24 to 36 hours or boiling them with acid leaves of hog plums or tamarind. They are not digested at all by the human stomach. Tender bamboo shoots are commonly preserved in brine or made into pickles with hog plums.

Other Leafy Vegetables

Brussels sprouts (*Brassica oleracea; bullata gemmifera*) and **cabbage** (*Brassica oleracea-capitata*).

Cabbage contains vit. A, B_1 and C, while Brussels sprouts contain only vit. C and a small amount of Iron

Celery (*Apium graveolens rapaceum*) contains a fair proportion of Proteins, Carbohydrates and Iron and a large amount of vit. A and vit. C.

Lettuce is similar to celery but comparatively poorer in respect of nutrition and vit. A, but contains vit. B_1 in addition. It contains an alkaline milky fluid once used by Roman beauties to remove freckles from the face.

Parsley (*Petroselinum sativum*) - Contains a fair proportion of Proteins, Carbohydrates and Fe and vit. A and C.

Rhubarb (*Rheum Rhaponticum*) Stalks are devoid of much nutrition but contain a bitter principle, which has both a laxative and binding effect on the bowels and useful in cases of indigestion with diarrhoea. Rhubarb contains oxalates which appear in the urine as a white sediment and is, therefore, to be avoided by those suffering from gravel.

Cauliflower (*Brassica oleraeca botrytes*) consists of:

Water	89.43
Proteins	3.5 p. c.
Carbohydrates	5.29 p. c.
Fat	Trace
Minerals	Small amounts
Vitamins	A, B_1 & C, small amounts.

Cauliflower is much the most easily digested and most completely absorbed also.

Artichoke (*Cynara Scolymus*) contains about 16 p. c. carbohydrates and traces of Iron, vit. B_1 and vit. C.

Gourds

1. **Ashgourd** (*Benincasa Cerifera*) - ಕುಂಬಳಕಾಯಿ (Kalyanapusini; Pullagummidi; Chalkumra; (Kushmandam in Sanskrit)— Is mostly water, contains traces of protein and carbohydrate and of mineral salts and vit. B and C. It is a tonic (Rasayana) according to the Ayurveda. What chemical constituents make it so is not known, probably the mucinous principle contained it.

2. **Bitter gourd** (*Momordica Charantia*)—(Karli; Pavakai· Haglakai). Two varieties are available in Southern India, the long pulpy and the small. Both are bitter and are in common use, both contain fair amount of Fe and vit. A, B and C. They are good stomachics, liver stimulants and laxatives. An allied variety of gourd but sweet, known as Meripavaka (Tamil) Phagil (Konkani). Parval (Hindi & Bengali) is a rare delicacy. It grows wild in jungle parts.

3. **Pumpkin** (*Cucurbita maxima*) ಚೀನಿಕಾಯಿ (Nallapusini; Gummadi). It is called Chinikai in Canarese either because it is

originally a Chinese product or because it is sweet, as some varieties are. Contains vit. A, B and C in small quantities.

4. **Ridge gourd** (*Luffa acutangula*) ಹೀರೆಕಾಯಿ (Peekankai) is a sweet variety commonly grown in South India, contains traces of vit. A and B_1. There are several varieties of these grown in South India.

5. **Milk gourd** or Bottle gourd or Calabash cucumber (*Laginaria Vulgaris*) Soraikai. Is a nice diuretic and recommended in cases of catarrhal jaundice being a liver stimulant also. No vitamins.

6. **Snake gourd** (*Trichosanthes Anguina*) Padalangai, ಪಡ್ಲಕಾಯಿ, A sweet variety containing 5 p. c. of carbohydrates, trace of mucin, iron and vit. A. Has a peculiar flavour like prussic acid.

(There is a bitter and smaller variety used in medicine by the Hakims and Vaidyas. It has antipyretic and antiperiodic properties).

7. **Cucumber** (*Cucumis Sativus*). There are several edible varieties, some of them are eaten raw, or cooked in the tender and unripe condition; others eaten only when ripe and are like melons. They are crisp when tender and have an agreeable flavour and used in making sandwitches. Contains traces of vit. B and C. (*See 'Melons' later*).

8. **Goa fruit** – Kovaikai (*Coccinia Indica*)—ತೊಂಡೆ ಕಾಯಿ grown extensively on the West Coast and grows wild in the hilly tracts of the Circars. The unripe fruit is used cooked as vegetables.

Chow-chow (*Sechium edule*) -Bilati Baigun. The marrow is sweet when cooked from the presence of carbohydrates and forms a delicious vegetable for the table. Its nutrient and vitaminous contents are very little.

Brinjals (*Solanum Melongena*) (Egg fruit) contains 6.5 p.c. carbohydrates, trace of proteins, of iron and vitamins. There are several varieties cultivated in India. The smaller varieties are nicknamed 'gentlemen's toes' as opposed to 'ladies' fingers,' the bendekai.

A big round delicious variety is the one grown in South

Canara particularly at Matti, near Udipi, which is practically a delta formed by a mountain stream. They are easily cultivated, are good bearers and form an important economic article of diet for 4 to 6 months in the year.

Kandankathri *(Solanum Xanthocarpum)* ಕಲ್ಯಾಂಟು a small thorny variety, bitterish in taste makes delicious dish. Although not digestible in itself on account of its thick skin and abundance of seeds they excite the flow of saliva, are useful stomachics and aid digestion. Their nutritional value is very little. They are given even to feverish patients.

Sundakai (*Solanum Torvum*) is found to contain a good amount of carbohydrates, proteins, a fair proportion of Fe, Ca and P and vit. A. Is very much in use in Tamil districts and is recommended as a digestive tonic for the weak and the anaemic.

Tomatos (green) (*Lycopersicum esculentum*) contains both while green and ripe:

Proteins	1.88 p. c.
Carbohydrates	4.57 p. c.
Iron salts	2.37 p. c.
Fat	Trace
Ca & P salts	Trace
Vit. A, B & C	Fair quantities.

The acidity is due to citric acid.

Ladies' Fingers (*Hibiscus Esculentus*) - Bendekai—Okra—contains a fair amount of Proteins and Carbohydrates, Ca, P and Fe salts and vit. A, B_1 B_2 and C. The mucin contained in them is a tissue-sparer. Bendekai forms an ideal vegetable food for the weak and the invalid and those suffering from neurasthenia, Beriberi and sleeplessness.

Drumsticks (*Moringa Pterygosperma* contains a fair amount of Protein and Carbohydrate, trace of fat, a fair amount of Fe and Ca salts and vit. A and C. It is said to stimulate the liver

Plantains (green). Most of the varieties used as food contain starch as much as 14 to 18 p. c., a little protein and fat. They are all deficient in neutral salts, but contain a fair amount of vit. A, B_1, B_2 and C. Plantain meal or flour prepared from one

variety of plantain (known in South Kanara as ಬೂದಿ ಬಾಳೆಕಾಯಿ) is extensively used as Infant's food and food for invalids and dyspeptics, especially those suffering from too much of acidity in the stomach. The well grown green fruits are baked by steam, peeled and made into a paste in a mortar, then dried and powdered. It is preserved by the addition of omum (carum copticum). A Teaspoonful of the meal boiled in water, and mixed with milk forms a fattening food. *(See Banana meal)*.

The unripe fruits sliced and fried in ghee or oil is a common preserve, having good keeping qualities

Plantain flowers and stalks are also used as greens; they contain a lot of fibre except while tender. Plantain flowers are credited with curing diabetes, and the fresh juice of some varieties of plantain stalk grown in Ceylon is reputed to be a cure for snakebite, a cupful of the juice being given freely by the mouth; while other varieties are said to help the solution of gravel in the urine.

Jack *(Arto Carpus integrifolia)*. The tender jack is used as a vegetable, but is fibrous and indigestible. The seeds of the fruits are very nutritious containing 6.6 p. c. proteins: 38.45 p. c. Carbohydrates, trace of Ca, Fe, Phosphates and Sulphur, and are largely used as food by the poorer classes in villages. Biswas finds on analysis that the ripe seeds are not a negligible source of vit. B_1 particularly in consideration of their large consumption and that the vit. B_2 content is almost twice as much as their vit. B_1 content.

The variety of Jack—ನೀರು ಗುಜ್ಜೆ - not bigger in size than the bread-fruit but with its leaves resembling those of the latter and having seeds also is very common in the West Coast.

Bread fruit *(Arto Carpus Incisa)* ದೀವಿ ಹಲಸು, ಬಿಲಾತಿ ಹಣ್ಣು This is a variety of Jack originally the native of Laccadive Islands, hence known as Deevi Jack. It is seedless and the tree is propagated mainly by root cuttings. When ripe they are sweetish, but cannot be used as food unless cooked or fried. They contain a large proportion of starch and sugar, little fibre and are very nutritious but difficult of digestion; their absorption, however, in the intestines is nearly complete being mainly starch.

Mango (green) (*Mangifera Indica*) used mostly salted and made into pickles with mustard, chillis and spices and gingelly oil. Green mango contains about 8 p. c. Carbohydrates, malic and citric acids giving the sour taste and trace of oxalic acid, and in some kinds a fair amount of Terpenes (Turpentine smelling volatile oils) which gives the fruit the characteristic flavour. Both green and ripe mangoes contain fair quantities of vit. A and C.

Indian Gooseberries (*Emblica officinalis*) ನೆಲ್ಲಿ ಕಾಯಿ used salted or made into pickles with green mangoes. They have a sweetish and astringent taste. Have no foodvalue and are devoid of vitamins.

According to the Ayurveda gooseberry forms a Rasayana or tonic and is used in certain forms of dyspepsia, diarrhoea and dysentery for which purpose it is used preserved in sugar as morabba.

Cape Gooseberries (*Physalis Peruviana*) ಅರನೆಲ್ಲಿ (ರಾಜಾ ವಾಃಳೂ) are both sweet and sour when ripe and made into pickles with salt or morabba with syrup.

Chinese Gooseberries (*Karambola, Kamrang phal, Dharaphal, Sukapriya (=parrots being attracted to:)* a ridged variety of gooseberry used as condiments pickled with salt, mustard and chillis. The ripe fruits are sweet and sour and their juice has expectorant properties.

Bilimbi (*Averhoea Billimbi*) is sour, used like tamarind, fresh or dried.

Hogplums (*Sapindus Emarginatus*) ಅಂಬಾಡೆ ಕಾಯಿ used as greens and condiments.

Mushrooms are forms of edible fungi of which there are hundreds of varieties. Poisonous mushrooms or toadstools are inedible and are great irritants of the stomach and the bowels and cause paralysis of the nervous system.

Mushrooms shrink on cooking and emit a nice flavour. They are not however easily digested in the stomach. The difficulty is probably due to the amount of cellulose which they contain. Their absorption also is vey imperfect They have no nutritional value either although they contain a fair amount of nitrogenous matter.

The following are the characteristics of the edible varieties o mush-rooms. Local knowledge is of course important. In edible mushrooms the tops or caps are white when young and brownish when older, the fins or plates are slightly pink and the base of the stem pure white and has no covering of any sort. Cooks usually put a silver coin in while cooking and if the coin remains bright the mushrooms are edible.

Idiosyncrasy. Even the edible varieties produce symptons of poisoning like vomiting, urticaria etc., in some people who are peculiarly susceptible.

E. Nuts and Oil Seeds

Nuts differ markedly from the fruits in that they are of very high nutritive value, and bulk for bulk dry nuts are amongst the most nutritious foods we possess. Their general composition is as follows:

Protein	15 to 30 p. c.
Fat	50 to 60 p. c.
Carbohydrates	10 to 15 p. c.
Mineral Matter	1 to 2 p. c.

Vit. A. B_1, B_2 in varying quantities and vit. C only a trace.

Water forms about 4 to 6 p.c. even in dry nuts and oil seeds and cellulose about 4 p. c. on the average. It will be seen from the above that fats predominate very largely in the composition of nuts and there is no other vegetable substance so rich in fats as these. Advantage has been taken of this to prepare from nuts various fatty preparations which are used as cheap and efficient substitutes for butter in the kitchen. There is every reason to believe that the fuel value of these vegetable fats is equal to that of butter, while they are decidedly more economical also.

Ordinarily nuts are not readily digested in the stomach owing to their richness in fat and cellulose; by thorough mastication or by artificial grinding, frying or cooking this difficulty can be overcome. Regarding the absorbability there is no question that a large percentage of constituents of nuts is absorbed in the intestines, so much so it has been proved that it is quite possible even for long periods to supply the requisite proteins and energy

from a diet made up of selected fruits and nuts. Fine devision greatly aids their digestibility.

The nutritive value of nuts is no doubt extremely high and when suitably prepared they may form substitutes for meat to a considerable extent, as they, like meat, contain much protein and fat in small bulk. Nuts are even more concentrated food than cheese and should rather be used as part of the ordinary diet than as a supplement to an otherwise large meal.

The biological value of the protein of nuts is said to be below that of legumens.

Chestnuts Of all the members of this class of foods the chestnut is probably of the greatest general value as an article of diet. It is peculiar among nuts in containing a high proportion of Carbohydrates (45 p. c.) along with a fair amount of protein (6.6 p. c.) and fat (8 p. c.). The great value of the chestnut has been fully recognised by the poorer peasants of Central France, who make during the autumn and winter two meals a day from chestnut alone. The nuts are prepared by removing the outside shell, blanching and then steaming the kernels; milk and salt may be added if necessary; or the nuts are ground after blanching and the meal made into flatcakes like chappathis.

Hazelnuts (filberts) are also nutritious and have the following composition:

Proteins	8.5 p. c.	Approximately.
Fat	27.5 p. c.	
Carbohydrates	12.0 p. c.	
Water	rest	

Sweet Almonds. (*Amygdala dulcis*) are yet another very valuable form of nuts being specially noteworthy for the large amount of Protein (20.75 p. c.), fat (58.9 p. c.) but Carbohydrates only 10.5 p. c. contained in them. They contain a fair amount of Fe, Ca and P and vit. B, and have a high caloric value. They have the further advantage of being compact and portable. "No man" it is said, "need starve on a journey who can fill his waistcoat pocket with almonds."

A bland edible oil can be extracted from almonds, which

is used medicinally and for toilet purposes on account of its demulcent properties.

Cashew nuts. (*Anacardium Occidentale*). This is evidently an introduction into India from the West, as its botanical name indicates and is widely cultivated all over the West Coast of India and extensively in Africa. Cashew nut is a great favourite among the "nut-eaters" in America and Europe and India is one of the few countries of the world that export cashew-nuts in very large quantity.

The unpeeled nuts are fried, the brittle shell broken and the nut-kernel separated. The average composition of the Cashew nut (the edible kernel) is as follows:

Protein	22 p. c.
Fat	46 p. c.
Carbohydrates	23 p c.
Fe	5 p. c.
Ca, P	trace.

Vit. A and B_2 – fair quantity.

The nut has a high Caloric Value and an Acid Value of 5.21%. The Cashew fruit is also rich in nutriment. Dr. K. M. Shenai of Mangalore, who recently tested the vitamin content of the Cashew fruit, has found out that they are abundant in vit C. His results, which were corroborated by Dr. Aykroid of Coonoor, state that in every 100 c. c. of the juice of Cashew fruit there are present about 376 M.gms. of vit. C. Equated into Oranges, one Cashew fruit, Dr. Shenai opines, gives as much vit. C as eight Oranges of the best quality. In money value the vit. C that a dozen Cashew fruits supply the consumer can be estimated at Rs. 4 (See under Cashew fruits—later).

No edible oil can be extracted from the nuts by expression but the shells do yield in the process of frying a thick, tarry, empyrheumatic oil, which is commercially used for the preservation of wood from dry rot and giving the mud flooring of houses a hard water proof glaze. The oil has a high antiseptic value also and is used in chronic skin diseases such as ringworm, chronic eczema etc. as an external application properly diluted, as in the pure state it is highly irritant and visiccant.

Cashew fruits contain a lot of sugar from which cashew arrack is prepared especially in the Goanese territories, where the Excise Rules are not much enforced.

Cocoanut *(Cocos nucifera)* appears to have been introduced into South India from the Southern Islands perhaps Ceylon as its vernacular name, Tengai, (Tenkai) suggests; and the class of labourers that pluck the fruits from the trees are called Dweepavars (Islanders) corrupted into Deevars, Thevars, Thiyars etc. by which that class is known. The cocoanut palm is tapped for the sweet sap, which when fermented becomes toddy.

The tender cocoanut contains the sweet milk, which on analysis has been found to contain 0.5 p. c. protein, 9.0 p. c. carbohydrates, no fat and 90.3 p. c. water. It forms a cooling innocent drink in the hot weather; the fleshy pulp of the tender cocoanut is sweet and nutritious, containing 5.2 p. c. protein, 35.9 p. c. fat, 8.4 p. c. carbohydrates and 48 p. c. water; but the dried kernel from which the edible oil is extracted contains only 3.5 p. c. water, 6.0 p. c. protein, 57.4 p. c. fat, and 31.8 p. c. carbohydrate; it is, however, poor in minerals and vitamins.

The tender pulp is easily digested even by young children, in fact, it forms an important article of infants' food among the agricultural classes.

Cocoanut and its oil form the chief ingredients of vegetarian diet; the nut is very wholesome except for the large amount of fibre contained in it, which is an advantage giving a large quantity of ballast for the action of the bowels. The oil is also used for lighting purposes, in the manufacture of soap and for anointing the head and body.

The cake left after pressing out the oil is an excellent food for cattle and is said to increase the butter element in their milk.

Olive oil *(Bassia Longifolia)* Iluppai; ఇప్ప (Mhowa). Olive oil, extracted from the kernel of the seeds of the fruits, is an edible oil and has been extensively used in medicine and is use ful for lighting purposes. The ripe fruit is very sweet and has a nice flavour and contains 2.5 p. c. protein and 5.7 carbohydrate; the flowers are also sweet and contain a large percentage of sugar. A kind of arrack is produced from the fermented extract of the flowers.

Gingelly Seeds (*Sesamum Indicum, or Orientale, Til-seeds*). The dried seeds yield on pressure good edible oil containing as they do about 43 p. c. of fat; they also contain protein 18.3 p.c., Carbohydrates 25 p. c. and Iron (10.5 p. c.) and vit. A. As an article of diet gingelly seeds are, therefore, very nutritious and are usually eaten fried and mixed with Jaggery in the treatment of piles, in which condition it acts as a bland laxative also.

Groundnut Oil (*See page 240*).

Linseed (*Linum usitatissimum*) (ఎంకితి బీజం) contains about 38 p c. fat, which on expression of the seeds is available as a thick bland oil. The oil is useful in the preparation of oil paints and grease and is not used for culinary purpose. Linseed meal contains 30 p. c. starch and makes a nice poultice for surgical purposes retaining its heat long and having no tendency by virtue of the contained oil to adhere to the parts over which the poultice is applied.

Linseed tea is a bland demulcent drink administered in cases of gastric irritability from any cause or of irritant poisoning. Linseed oil is a good application for burns etc.

The oil cake is a good manure for plants and good food for cattle and is said to make the butter "Soft."

Walnuts (*Juglans Regia*) అక్రోట్. Their approximate composition is as follows:

Protein,	15.64 p. c.
Fat	64.49 p. c.; by far the highest percentage among nuts.
Carbohydrates	10. 9 p. c.
Iron	4.76 p. c.

Vit. B_1 and a high Caloric value.

Pista (Pistachio nut) *Pistacia vera*. The kernel has the following composition:

Proteins	19. 8 p. c.
Fats	53.51 p. c.
Carbohydrates	16.25 p. c.
Iron	13. 7 p. c.

No vitamins nor Ca salts.

* * * * *

Most nuts are eaten raw as then their vitamins are not lost and they perhaps taste better also than when baked or roasted. But their digestion is easier when cooked or roasted and absorption more complete.

Almost all the vegetable oils are devoid of carotene and vit. A with the exception of the Red palm oil already mentioned.

Dhoop oil (*Vateria Indica*) ಧೂಪ ಎಣ್ಣೆ. (Payinia, Malayalam). The tree grows wild along the West Coast of India and extensively cultivated as avenue trees in many places. They grow stout and tall, the timber is used for roofing purposes and lasts long as the wood contains a resinous substance which resists dry rot; the wood forms good fuel also burning with a bright flame by virtue of the resin.

The fruits are oval and resemble sapota fruits in appearance, size and shape; the peel is thick, gummy and can be easily separated for the kernel. The kernel is full of oil and little protein or nitrogenous matter. In the extraction of the oil the kernel is ground down with water and boiled, the oil collects at the top and is ladled away; or the kernel is steamed and pressed while hot, the oil is separated leaving the cake. When the oil cools it solidifies into a whitish waxy mass, which is worked into slabs or balls and preserved.

If niches are made into the trunk of the tree a highly aromatic resinous gum exudes, which is used in the preparation of varnishes. It is very inflammable and the powdered gum is used in the manufacture of pyrotechnics. A similar gummy resin is extracted from the peel of the fruit.

The kernel oil is sweet and edible and melts at low heat and is extensively used for culinary purposes. Its digestibility is much less than that of liquid oils, of vegetable or animal origin and its absorption also less complete. The oil is used extensively in the manufacture of vegetable oil soaps.

The oil cake contains 1.13 p. c. Nitrogen, 0.21 p. c. Phosphates and 0.04 p. c. potash and is used mostly as manure for plants. It is not used as fodder for cattle.

Unrefined vegetable oils turn rancid soon and develop a high acid content, sometimes as much as 10 p. c. Fresh vegetable

oil under the action of sunlight gets charged with carotene and vit. A, which are lost in refined oils. Solid oils as we said, are difficult of digestion and their absorption is only 15 to 20 p. c. To the poorer labouring classes who cannot afford to get milk or ghee, vegetable oils are the only chief fats they can depend upon for sustenance.

To remove rancidity of edible oils

Prepare a solution of soda bicarb 15 grammes in 100 c. c. of water. This makes a 15 p. c. solution. For every 4 ounces of the oil put in 3 drams of this solution, mix well by shaking vigorously and set aside for 24 hours preferably in the sun. Decant the top layer, which is entirely formed by the refined oil.

Another method is by putting in a small quantity of powdered common salt and shaking vigorously and setting aside for 24 hours and decanting the supernatant oil.

(F) Fruits

"To us a diet of one exclusive fruit meal and one hearty mixed meal seems to be ideal for civilised men." Mac Donald.

The fruit is not of direct benefit to the plant, it is intended as a bait to attract birds and insects and so insure the liberation and transport of the seed. Hence the aesthetic qualities (beauty, color, sweetness and flavour) predominate in fruit, rather than the strictly nutritive, and we eat them more for the sake of their sweetness and flavour than for the actual nourishment which they afford. Fresh fruits in general have the following composition:

Water	85 to 90 p. c.
Protein	0.5 p. c.
Fat	0.5 p. c.
Mineral matter	0.5 p. c.
Carbohydrates	6 to 12 p. c.
Cellulose	2.3 p. c.

It will be evident from the above that the only nutritive constituents of any importance in fruit are the Carbohydrates. These consist almost entirely of sugars as there are few ripe fruits that contain any starch.

The chief sugars present in fruit are fructose and glucose (=grapesugar) and in most fruits these are present in nearly equal proportions. Apples and Pears, however, contain much more fructose than glucose; whilst in most stone-fruits, on the other hand, glucose predominates. A few fruits such as cherries, grapes and figs contain no sucrose, whilst in a few others such as apricots and peaches sucrose makes up the greater part of the sugar present.

[The remainder of the Carbohydrates contained in fruits is made up of indigestible material like cellulose, pectin etc. which are of no material value as nutriment, but in the process of ripening some of them seem to be converted into a form of sugar—pentose—which has no nutritive value either.

It is the pectin contained in some fruits that produces a jelly when subjected to boiling with water. The amount of cellulose varies greatly in different fruits. It is always lessened by the process of cultivation and it diminishes also by a sort of natural digestion during the ripening of the fruit.]

The grapesugar or glucose of sweet fruits have the power of keeping up the heat of the body similar to that possessed by starch of bread, cereals and vegetables; but fruits are superior to bread or cereals, because the glucose in the fruit is ready for assimilation as soon as eaten, whereas the starch of bread and vegetables should undergo protracted and difficult digestion in the mouth and the intestines in order to be converted into glucose—**The starting point of the fruit-food.**

Another advantage and of equal importance is that fruits contain specific "organic" acids—tartaric, citric and malic—which have an aperient action on the bowels by stimulating their activity and that of the liver and thus purify the blood and the system.

The mineral constituents of fruits are of considerable importance. They consist mainly of Potash united with the various acids referred to above. They have an agreeable acid flavour and are converted in the body tissues into Carbonates and serve to render the blood more alkaline and the urine less acid. Thus one ounce of lemon juice contains about 50 grs. of Citric acid and is able to neutralise 50 grs. of Sodium Bicarbonate.

As the fruit ripens these vegetable acids diminish to some extent, and it is to this fact, coupled with an increase in the amount of sugar present that the sweetness of ripe fruit as compared with unripe fruit is due.

The salts of Ca and P (Phosphorus) are but poorly represented among the mineral ingredients of fruits in general, but oranges are a good source of Ca, and for this reason the free use of fruit in place of cereals has been recommended to persons suffering from atheroma (pipestem arteries) and high Blood Pressure.

Most of the fresh fruits are rich in vitamins especially vit. C, the antiscorbutic principle.

The flavour of fruits is due to the presence of certain etherial bodies, which in some cases defy chemical investigation. In many cases, however, artificial products having the same flavour as many fruits have been synthetically produced from coaltar etc. These products form the basis of different fruit-flavourings and essences sold in the market.

Although of no nutritive value the flavouring agents contained in fruits are by no means to be despised as they are stimulants to the appetite and aids to igestion. But their fuel value is practically nil.

Cooking renders most fruits digestible by softening the cellulose and converting the gum (pectin) into a jelly; but these changes are not brought about without a good deal of loss, and where the fruit is cooked by stewing and the juice also eaten along with it the loss caused by cooking is negligible.

The digestibility of fruit in the stomach and the intestines is largely dependent on the nature of the fruit and its degree of ripeness. Ripe fruits are more easily digested than unripe fruits as the amount of cellulose in the latter is greater.

Excessively sour-fruits do give rise to colic or diarrhoea from irritation of the intestines, but if the amount of acid and of the cellulose contained in the fruit be moderate the gentle stimulation which they exert on the intestinal wall may be whole some as in constipation. Stewed fruits are therefore so serviceable an addition to diet in sluggish action of the bowels.

Regarding their absorption major part of the Carbohydrates, proteins and fats contained in fruits are absorbed.

Fruits should preferably be eaten after food as desserts especially sour fruits, those containing acids.

* * * * *

From a nutritional point of view fruits may be artificially classified into 2 groups.

(1) Flavour fruits—those that contain more than 80 p.c. of water—such as apples, lemons, limes, mangoes, melons, oranges, papayas, peaches, pears, pineapples, plums, pumelo, sapotas and tomatoes.

(2) Food fruits—all fruits having more than 20 p. c. of solids, e. g. bananas, dates, figs, prunes, raisins and bread fruit.

The only claim of the members of the Flavour fruits group to be regarded as foods is that they contain a small amount of sugar in a pleasant but rather bulky form and also the antiscorbutic vit. C. They are chiefly eaten for the sake of their agreeable flavour. Their richness in water makes them more adapted to the requirements of the inhabitants of the warmer climates and if they are freely represented in the daily diet the need for the consumption of water separately will be rendered minimum.

Grapes (*Vinis vinifera*). These stand intermediate between the groups, for their juice contain an amount of sugar (glucose and fructose) varying from 10 to 30 p. c.

In the so called "grape cure" from 2 to 8 lbs. of grapes are taken daily in divided quantities and between meals. If the rest of the diet is sufficient the patient may gain in body weight on this regime, while the grape juice, owing mainly to the organic acids which it contains acts as a mild laxative and diuretic and at the same time diminishes the acidity of the urine.

In the "grape-cure-treatment" as in all similar treatments much of the good that results is due to particular circumstances in which the "cure" is carried out, for example, the patient himself is made to gather the grapes and this means a certain amount of exercise to him in the fresh air and sunlight. It is

chiefly in cases of so called abdominal plethora, the result of habitually eating too much and taking too little exercise, that benefits have been obtained from such a course of treatment, but it is also useful in some cases of chronic Bronchial Catarrh.

Grapes contain very small quantities of vit. A and vit. C and traces of vit. B_1. A kind of drink—Mostelle—an unfermented grape juice prepared by pasteurisation—contains about 25 p. c. grape sugar and forms a useful beverage in the hot weather and in fevers.

The "food" fruits on the other hand are not to be despised as sources of real nutriment. Of this group the banana is a very good example.

Banana (*Musa Paradisiaca*—fruit of the Paradise as its vernacular name also implies). In the fresh state the fruit contains a fair amount of carbohydrates (36.4 p. c.) and an appreciable amount of protein (1.33 p. c.) as well; while bananas dried in the sun and sprinkled with crystal sugar to preserve them better, compare favourably with dried figs in nutritive value and are a pleasant substitute for them as dessert. Banana fruitscontain only à trace of vit. A, vit. B_1 and vit. C and very little mineral salts

In the ordinary form, however, the banana is too bulky to be able to serve as the main constituent of a healthy diet, containing as it does about 65 p. c. of water. Assuming that an average specimen weighs about 5 oz. without the peel, it would require about 25 fruits to yield the amount of energy required daily, and nearly 50 fruits to supply the daily requisite amount of protein. No wonder, then, that in tropical countries where the banana is largely eaten the inhabitants are apt to show an undue abdominal development.

The unripe banana is dried and used to produce banana meal or flour, which has the following composition. For comparison the composition of wheat flour is also given alongside below:

		Banana Flour	Wheat Flour
Protein	...	4.0 p. c.	7.9 p. c.
Fat	...	0.5 p. c.	1.4 p. c.
Carbohydrate	...	80.0 p. c.	76.4 p. c.
Mineral matter	...	2.5 p. c.	0.5 p c.
Moisture	...	13.0 p. c.	13 8 p. c.

It will be seen that banana meal is richer in carbohydrates and mineral matter than wheat flour but much poorer in proteins. If rice, on the other hand, had been taken for comparison it would have been found that banana flour is about equal to it in nutritive value. It is made into a sort of bread and flat cakes and is easily digested.

"Bananina" is a proprietory food obtained from the banana and is designed for the use of Infants and Invalids and contains about 4 p. c. more carbohydrates than banana flour but is stated to be easily digested.

One important advantage of banana is the cheapness with which it can be produced. It has been found by experience that a given area of ground devoted to its cultivation will yield a larger food-return than if it were planted with potatoes. The bread fruit, the sugar cane and chest nut, however, exceed the banana in their food-yield per acre.

Surpassing even the banana in nutritive value is the group of dried fruits, such as, dates and raisins, figs and prunes.

The date is indeed as much a staple article of diet to the Egyptian as rice is to the Hindu but the carbohydate of rice is mainly in the form of starch, while in the date the carbohydrate is almost solely present as sugar, which is much more readily digested and more completely absorbed than starch.

Dates *(Phoenix dactylifera)* contains the following:

Protein	3.04 p. c.
Carbohydrate	67.31 p. c.
Fat	Trace
Iron	10.58 p. c.
Vit. A, B_1 & B_2	Good quantity
Vit. C	Trace

and a high caloric value.

Dates form a good dessert after a mixed meal.

Indian Dates *(Phoenix Sylvestris)* Ichapalam ಈಚಲ ಹಣ್ಣು Bastard Date. They are a very poor imitation of the Egyptian variety; but the palms grow wild even in dry sandy soil in India and are tapped for their sweet juice, from which both jaggery and toddy can be prepared.

Figs (*Ficus Carica*) is another valuable member of the group of food fruits. In the undried state figs contain a large percentage of water as much as 80 p. c.; protein 1.31 p. c. and Carbohydrates 17.0 p. c.; they also contain a trace of Iron and and vit. C.

Dried figs on the other hand contain only 15 p. c. of water and are therefore more concentrated in respect of proteins (4 to 5 p. c., and Carbohydrates (65 to 70 p. c.) and have a high caloric value; weight for weight figs are more nourishing than bread; and a pint of milk and 6 oz. of dried figs make a very good meal.

One pound and a half of figs yield about 400 grammes of Carbohydrate or $\frac{1}{5}$ of the total requisite amount of the nutritive ingredients required daily.

Raisins (or Sultanas) (*Vitis Vinifera*) are dried grapes and contain about 78 p. c. grape sugar, 2.0 p. c. proteins, 4.0 p. c. Iron and trace of vit. B_1. They are as nutritious as Dates or Figs.

Prunes (*Prunus Domesticus*) and Raisins have all similar composition and are equal to Dates and Figs in their nutrition. Raisins contain traces of vit. B_1 and vit. C.

Apples (*Pyras Malas*) contain:

Carbohydrates	...	15 p. c.
Proteins .	...	trace
Iron	..	trace
Vit. A, B_1 & C	...	small quantity.

They contain little fibre and are absorbed more or less completely. Apples are rich in malic acid and even young children should be encouraged to eat them freely.

Bullock's Heart—Ramphal (*Anona Reticulata*) contains about 21 p. c. Carbohydrate and are difficult of digestion. They are devoid of any vitamins.

Custard apple (*Sitaphal -Anona Squamosa*) has similar composition and properties.

Guava (*Psidium Catelianum* or *P. Guyava*). The pulp is full of Fructose and pectin and when boiled sets into a jelly. They contain vit. A and vit. C in large quantities. The kernel of the seeds is very nutritious and is said to contain vit. B_1.

Jack fruit contains a large p. c. of sugar as much as 18 to 20 p.c., but being fibrous it is difficult of digestion and gives rise to colic and diarrhoea. Jack fruit contain vit. A in fair quantity and vit. C also. Jack seeds, we have seen, contain 38 to 40 p.c. Carbohydrates, 6.6 p.c. protein and traces of Sulphur, Iron, Phosphates and also small quantities of vit. B_1 and B_2. Seeds contain no fat.

Jambu fruit (*Eugenia Jambos*) ಜಂಬು ನೇರಳೆ has 20 p.c. Carbohydrates and trace of organic acid. It is devoid of any vitamins.

Sour-Soup ಓಡಂಬ a sour fruit used as a condiment and used for soups.

Citrus Fruits

There are nearly seventy varieties of citrus fruits grown in India alone. The commonest are:

1. Citron – Citrus medica—ಮಾದಳಂಗ—is either sweet or sour.
2. Lime fruit—Citrus aurantifolia—ಲಿಂಬೆಹುಳಿ.
3. Lemon – Citrus Limonia.
4. Bitter Orange—ಕಜಾರಂಗ—Citrus aurantium—is mostly used salted as pickles is a liver stimulant and is useful in jaundice and enlarged spleen.
5. Mozambique Lemon ಮುಸುಂಬಿ—(Citrus Limotoidis).
6. Batavian Orange – (Citrus Madras patana).
7. Bomblimas – Shaddock (Citrus grandis – Citrus Decumana. Pumelo – ತೊರಂಜ).
8. Grape Fruit—Citrus paradisii.
9. Sweet Orange – Citrus Nobilis.
10. Satkudi Orange Citrus Sinensis.

One variety of limes, known as Citrus Limeta, ಗಜಲಿಂಬೆ—ಕೊಡಲಿಮಂಚಿ elongated in shape, is very sour but has no particular flavour. They are used only salted or as drinks with sugar.

All the varieties of Citrus contain vit. C; oranges, pumelo and limes contain **in addition vit. A** also; and grape fruits contain vit. B_1 and C only.

The peel of all varieties of Citrus especially that of orange (sweet and bitter) and pumelo has in its outer covering minute glands containing aromatic volatile oils, by virtue of which, the

peel even when fresh burns with a bright flame, emitting a fine aromatic fragrance, which has mild disinfectant and deodorant properties. Fumigation with the powdered peel drives away mosquitoes from the room for some time.

Orange peel being bitter is used in the preparation of jams and marmalades.

Mangoes are very rich in vit. A and vit. C and surpass even the apple in this respect and also in the matter of Carbohydrates and protein but not in the matter of mineral salts such as those of Ca, Fe and P.

Mangostein (*Garcinia mangostena*). The pulp is sweet and has a good flavour, but the rind is very astringent. The Indian variety, known as Bhirindi, has its rind very sour and the pulp sweetish. The rind is used with condiments in the preparation of an appetising soup to be taken with rice diet.

A third variety of mangostein is exactly like the mango in shape and flavour but is very sour even when ripe. It makes a nice jam.

Palmyra Fruit. Tender fruits contain sweet edible pulp with an agreeable fine flavour, but when the fruits ripen the kernel becomes hard and indigestible. Palmyra fruit forms nice fodder for cattle and for pigs and contains no fat.

Pappaya—Papaw—(*Carica papaya*). In addition to about 12 p.c of Carbohydrates, and traces of proteins papayas are very rich in vit. A and vit. C. The rind of wellgrown unripe papaya contains a digestive ferment—papain allied to pepsin of the gastric juice and capable of digesting protein matter. Papaya fruit is a good laxative and is useful in cases of piles. Papaya is a useful fruit for administration even to young children.

Papaya is the most economic of the tropical fruits and is easily grown from seeds and yields fruits within 10 months from the date of the sowing of the seed. The plant does not require particular care and its cultivation deserves to be encouraged.

Peaches (*Amygdalis Persica*) contain about 7.6 p.c. of Carbohydrates, very little proteins, and only traces of Iron salts and traces of vit. A and vit. C.

Pears. English Pears (*Pyrus Achras*) are mealy and sweet.

The country variety (*Pyrus Communis*) contain a lot of fibre. Both varieties contain about 12 to 14 p.c. of Carbohydrate and small quantities of vit. A, vit. B_1 and vit. C.

Pears (*Avocado*)—Aliget. Butter-fruit (*Persea drymifolia*) is the only edible fruit containing a large percentage of fat, as much as 23 p.c.; but it contains very little Carbohydrates and traces only of vit. C. The fruit has just been introduced into Southern India (Coorg) and the Nilgiris (Coonoor).

Pine apple (*Ananas Sativus*) is a juicy fruit containing a fair amount of vit. A and vit. C and about 12 to 15 p.c. Carbohydrate but only trace of protein. Pine apple is also a tropical fruit introduced into India first by the Dutch settlers about begining of the 16th Century. The Kew and the Mauritius variety are now extensively grown in Southern India. They are crisp and tasty and have a nice flavour and are fibreless. Pine apple preserves and syrups are common beverages in the hot weather.

Pine apple is a gentle stimulant of the liver and is usually recommended for chronic cough of some variety.

Plantains (*Musa Sapiens*). There are many varieties of this fruit grown in India and each has its own peculiar flavour. They are all sweet when ripe, fairly rich in vit. A and vit. C. Taken as dessert after food the ripe plantain is a good laxative and is recommended in habitual constipation.

Plums (*Prunus domestica*). The yellow variety contain a fair amount of vit. A and vit. B_1 and only trace of vit. C.

Pomegranate (*Punica granatum*) is slightly astringent in action and is a good food in chronic diarrhoea. The sweet variety contains about 15 p.c. of sugar, trace of protein and a small amount of vit. C.

There is a variety, which is very sour and is used as an astringent in diarrhoea and dysentery.

The root bark of the tree has an active principle, which has a vermifuge effect on tape-worms.

Wood apple (*Feronia Elephantum*). Kapittha, vilapalam—has good flavour, is nutritious and is a good laxative.

Sapota (*Achras Sapota*)—Chukku fruit—is a sweet nutritious fruit having laxative and diuretic properties.

Country plums (*Zyziphus jejuba*). Badari—have a big stem and thick skin but little pulp. The pulp is not easily digestible and causes windiness.

Tamarind (*Tamarindus*). The word derives its origin from Tamar, an Arabic word meaning dates, and Ind meaning Indian.

The pulp contains:

Carbohydrates	65.0 p. c.
Protein	3.2 p. c.
Iron	10.5 p. c.
Vit. A	good quantity
Vit. C	trace

Tamarind is a good laxative, also useful in chronic constipation.

Tomato fruits (*Lycopersicum esculentum*). The ripe tomatoes are included among fruits, contain little nutrition but a fair amount of vit. A, vit. B_1 and vit. C. Tomatoes are good diuretics. Tomato juice can be given to children and infants after each feed and acts as an antiscorbutic against infantile scurvy.

Sugar

There are several varieties of sugar entering into the composition of all sweet articles of diet.

(1) Cane sugar (Sucrose) is commonly derived from the sugar cane, the beetroot, the American Sugar Maple and the bastard date; but although when derived from other sources than sugarcane and special names given, such as beetroot sugar or maple sugar it must be distinctly understood that all the sugars are chemically identical.

(2) Malt sugar (maltose) derived from malt.

(3) Milk sugar (lactose) from milk.

(4) Glucose (also called Dextrose or grapesugar) occurs abundantly in grapes. Commercial glucose is obtained by boiling starch with acids and occurs in thick syrupy mass.

(5) Fruit sugar (Levulose) is found in most fruits.

(6) Invert sugar (a mixture of glucose and levulose). It

can be prepared from canesugar by the action of ferments or by simply boiling it with acids. Honey is the commonest type of Invert sugar obtained in Nature and contains equal parts of dextrose and levulose, the flovour of honey being due to the presence of small amounts of volatile oils derived from flowers.

Composition of Honey—Average sample of Indian

Honey contains:	Sucrose	1 per cent.
	Glucose	35 per cent.
	Levulose	39 per cent.
	Enzyme-Diastase	10 per cent.
	* Phosphat acid—a certain amount.	

* *For the first time the presence of this was detected in honey by Dr. K. V. Giri of the Indian Institute of Science, Bangalore.*

Malt

Malt is obtained by moistening barley and allowing it to germinate in heaps at a moderate and regular temperature. During the germination important changes take place. The ferment, diastaste, appears in the grain and acts upon some of the starch converting it into dextrin and malt sugar, while, part of the (insoluble) proteins by the action of another ferment is also converted into soluble forms of proteins. The "green malt" so produced is next dried and when the drying is complete the malt is ground and made into a mash with water; when allowed to ferment longer malted liqours are produced, such as Beer etc.

Malt Extracts are prepared by evaporating down an infusion of malted barley at low temperatures or in vacuo, the object of evaporating in that way being to preserve in active form the diastase ferment present in the malt.

Malt is a nourishing and fattening food and helps when combined with other foodstuffs the digestion and absorption of such foodstuffs especially the cereals. Malt contains vit. A, B_1 and C.

Malted foods like Horlick's Malted Milk, Benger's Food, Ovaltine etc. are prepared from barley malt.

A method of preparing malted food from cholam has been

evolved by the Agricultural Chemist at Coimbatore (S. India) which is as follows:

"The grain (cholam) is soaked in water for a day, during which period the water is changed four times. The wetted grain is allowed to sprout for 3 days and dried in the Sun. The sprouts and husk are removed by pounding in a wooden mortar; and the husked grain gently roasted till a fine aroma is given out. Fine malted flour from the crushed grain is fit for use in different ways:

"In the sick room a thin "conjee" of the flour with milk and sugar helps to nourish the patient. By suitably altering the consistency this beverage can be given to children and people with weak digestive powers. For general use even by the healthy it can be mixed with cocoa to make it more sustaining. The malt flour when mixed with wheat flour and other ingredients can be used in the preparation of Biscuits or Cakes."

Malt—making as a cottage industry has a wide scope as it is applicable to other cereals as well.

Jaggery

This is prepared from sugar-cane juice, palmyra juice or juice of the bastard date. The raw juice is boiled until thick and syrupy and then poured into moulds to harden into solid cubes. The jaggery so produced is generally unclean, dark and unattractive. It was therefore felt that development of a method for the production of a superior type of jaggery was an absolute necessity. Investigation carried out in this respect have materialised in a method at once suitable and practical in the hands of the small as well as big cane-growing ryot. The method is as follows:

The raw juice is heated to the boiling point, the scum carefully removed and the boiling juice poured on a bed of activated carbon and sand contained in a conical cylinder with a perforated bottom. The activated carbon by virtue of its porous structure absorbs and removes from the cane juice a major portion of the impurities normally present in the juice, such as albuminoids, gums, colouring matter etc. The resultant juice is almost colourless and much purer than the original raw juice,

and on concentration it yields an excellent jaggery — cream jaggery—possessing a very attractive white creamy colour and good keeping qualities

Prof. Gajanan uses for the preparation of cream jaggery a tin lined brass pan for boiling the cane juice and employs milk and the mucilaginous juice of the okra plant (വെണ്ടയ്ക്ക) (Hibiscus esculantus) and he demonstrated his method at the Swadeshi Exhibition held in Calicut in January 1938 and actually produced the jaggery on the spot

As noted already jaggery is superior to refined sugar as an article of diet as it still retains some of the Proteins, salts of Fe and vitamins of the original cane or beetroot, while they are absent in refined sugar. Moreover, constant use of refined sugar has been found by experience to be irritating to the system.

Saccharin

Saccharin is a synthetic chemical product and is a good sweetening agent for use in cases where sugar as such is contraindicated as in Diabetes. But saccharin has no food value whatsoever. Sucrol (or Dulcin, meaning sweetener) is also another synthetic product allied to saccharin. Saccharin or sucrol are both bitter to the taste in concentration but when diluted with water it is very sweet and much sweeter than sugar; so much so that 2 or 3 grs. of which to a cup of tea or coffee makes the drink sweet.

Commercially saccharin is extensively used in the manufacture of sweetened aerated waters as it is much cheaper than sugar inspite of the very heavy import-duty imposed on it in India.

G. Condiments and spices

Are mostly flavouring agents; although devoid of proper nutriment they have a high caloric value.

Asafetida (*Ferula Fetida, F. Narthex*) is the gummy exudation (resin) obtained by incision from the bark of the tree; it is miscible with water making a whitish emulsion. Has highly carminative and antispasmodic properties and contains much Iron and Ca.

Cardamoms (*Elettaria Cardamomum*) ಏಲಕ್ಕಿ is generally added to sweets or drinks as a flavouring agent.

Chillis (green and dry) (*Capsicum*) are very pungent especially the small variety (*Capsicum minimum*) and contains a large quantity of vit. A and vit. C.

[What is known as **Paprika** is a variety of chillis (*Capsicum annuum*) cultivated largely in Europe (Spain, Italy and Hungary). It is said to contain nearly 4 times the amount of vit. C as is contained in an equal weight of orange pulp].

Cloves (*Eugenia Caryophyllata*) is also a powerful aromatic and forms a constituent of the well known compound Gharam masaal.

Coriander (*Coriandram Sativum*) also contains Fe and Ca and large quantity of vit. A.

Cumin Seeds (ಜೀರಿಗೆ) (*Cumium Cyminum*) are powerful carminative and diuretic. Contain a fair amount of Ca, Fe and vit. A.

Fenugreek Seeds (*Menthe*) ಮೆಂತೆ. Contains the same principles and constituents as cumin seeds.

Cinnamon ದಾಲಚೀನಿ is said to have a large proportion of Fe and Ca. Is a powerful carminative and astringent.

Ginger (*Zengiber Officinalis*) is powerful carminative, diuretic and liver stimulant and its juice is a good remedy for jaundice.

Mace (*Myristica fragrans*) is from nutmeg, contains an aromatic principle having slight intoxicating properties. It is a powerful metabolic stimulant and has a high caloric value.

Mustard (*Brassica Juncea*) is a useful condiment having a high caloric value. When ground into a paste with **cold water** and applied as a plaster it produces a rubefacient effect on the part and relieves deeper inflammation and pain.

Pepper (*Piper nigrum*). Pepper is a common condiment used in the place of Chillis. It is a good diuretic and useful antipyretic and is a common household remedy for influenza and common cold. It is an antiperiodic also and is commonly taken as Tea at bed time as a preventive against Malaria fever. Pepper contains a small amount of vit. A and vit. C.

Cubebs (*Piper Cubeba*) ಬಾಲ ಮೆಣಸಿಗು—ಗಂಧ ಮೆಣಸು

Poppy seeds ಕಸಕಸೆ are commonly used in some forms of drink; contain vit. A and B_1 and C.

Omum (*Carum Copticum*) Ajowan. Is a good carminative and antispasmodic.

Turmeric (*Curcuma longa*) is used for its characteristic flavour and yellow colour. It is a good intestinal sedative and disinfectant.

Vitis—perandai—a creeper, quadrangular in section, containing a lot of mucin, used in the preparation of pappadams.

Betel leaves (*Piper betel*) are powerful aromatics and oral disinfectant and deodorant. They excite the flow of saliva in the mouth and indirectly that of the gastric juice when chewed after food. Betel leaves contain a large quantity of vit. A but only a trace of vit. C.

Animal *Versus* Vegetable Foods

1. The most striking characteristic of vegetable foods in general is the large proportion of carbohydrates which they contain, and this peculiarity should at once distinguish vegetable foods. from animal foods; the latter, with the exception of milk and its preparations like butter and cheese and some forms of fish (Oysters), contain little or no carbohydrates; animal foods on the other hand are rich in proteins and fats. Hence richness in proteins and fats can be said to be characteristic of animal foods.

We have, therefore, the chief difference between the vegetable and animal foods in that the former is rich in carbohydrates the latter are in general rich in proteins and fats. But most vegetable foods possess not merely abundance of carbohydrates but contain proteins and fats as well. For example, pulses are peculiarly rich in proteins, and some form of nuts (cocoanut, ground nut, almonds, etc.) are rich in fats (oils) too.

2. Now, the carbohydrate is by no means such a concentrated form of carbon as fat is; in fact, 100 parts of fat are equivalent to about 220 parts of starch. This explains why vegetable foods have to be taken in much larger bulk than animal food; in other words vegetable foods are dilute and bulky, while animal foods are concentrated and compact.

3. We saw that animal foods although rich in proteins and fats are deficient in carbohydrates and that vegetable foods are rich in carbohydrates and contain proteins and fats also in varying amount. It is, therefore, clear that vegetable foods more than animal foods do combine in them all the three nutritive elements of foodstuff, viz. proteins, fats and carbohydrates. In view of this fact it must be pronounced that the vegetable kingdom is a better source of human food supply than the animal kingdom, and that if one should confine in his selection of a dietary exclusive of one kingdom or the other preference has to be given to vegetable foods; for it is undoubtedly possible to live on vegetarian diet alone, while it is difficult or impossible to live for any length of time purely on animal foods.

4. Now, we have seen, while discussing the differences between animal and vegetable proteins, that animal proteins have a higher biological value than vegetable proteins and that consequently vegetable proteins are not quite suitable for body growth and repair and have to be taken in much larger quantity, and that physiologically it has been found that proteins of high biological value raise the biological value of the poorer foodstuffs when mixed with them; we have also seen that the function of milk—protein is to render the vegetable protein of wheat or cereals or pulses of greater value in nutrition than they otherwise would be; so also cheese, eggs, fish and meat.

It is therefore clear that it is advantageous to combine in one's diet both animal and vegetable proteins and this combination is essentially necessary during the period of growth. In this connection it may be said that no human being can, strictly speaking, be said to be a life-long vegetarian; in foetal life his diet has been entirely animal in origin, the nutrition being derived from the mother's blood; in infancy also it consisted mostly of animal food in the form of milk, breast milk or cow's milk, and even in adult life the most orthodox vegetarian has no objection to milk or its products or even eggs; on the other hand he may be said to have a partiality to milk, curds and ghee. The main defence of the orthodox vegetarian in adopting a purely vegetarian diet is that the obtaining of meat, fish and fowl entails

the killing of the animal and that egg also from the beginning of its existence is but a living animal in embryo.

5. The vegetable proteins are mainly of the globulin class and are easily dissolved by water containing a little salt, so much so, they may be easily lost from vegetables allowed to soak in such a mixture either raw or in the process of cooking. Vegetable proteins do also contain nucleo proteins but to a lesser extent than animal proteins. This fact is of practical importance in the dietetic treatment of gout, in which free use of vegetable food is indicated rather than meat. The rationale of this treatment will be evident when we remember that the cause of gout is in main the presence of excess of uric acid in the blood, which forms a deposit in the joints and tissues interfering with their functions. This uric acid is formed from the nucleo proteins contained in foodstuffs like meat and also from certain "purin" bodies derived from coffee, tea, meat extracts, soups and alcohol. Salt is also contra-indicated in gout, so also salted meat and salted fish, but there is no objection for fresh fish in small quantities especially of the white variety.

6. Both varieties of protein, vegetable as well as animal, are coagulated by heat and are thereby rendered less digestible by cooking. Cooking, therefore, diminishes the digestibility of animal foods in general, because they are mainly composed of proteins. On the other hand cooking raises the digestibility of vegetable foods in general, because these contain, as a rule, very little protein, but much of starch, and starch, as we have seen, is rendered easily digestible by cooking.

7. Both animal and vegetable foods do contain a number of nitrogenous compounds which do not belong to the protein groups and, therefore, are of no practical value in dietetics, that is, which are not concerned either in tissue building or production of body heat or energy.

8. Regarding "extractives" they are present both in animal and vegetable foods to a varying extent. Potatoes, for example, do contain a substance called "asparagin" which is an extractive and though nitrogenous is not available to the body as food of any value.

9. Most of the vegetable fats are "oily" but most of the animal fats are in solid form. The oily nature however, of every fat, vegetable and animal, increases its digestibility; and the nutritional value of vegetable oils seems to be fully equal to that of the more solid animal fats. Thus, Cacao butter and Dhoop oil are equally well digested and equally fully absorbed as butter from milk, and olive oil as much as cod liver oil. But most of the animal fats are, we have seen, bearers of vitamins, and none of the vegetable fats contain them except the Red palm oil (Elaicis guineensis)

10. Of the carbohydrates we have already noticed starch and sugar. Sugar is the form in which the carbohydrate circulates in the plant and starch is the form in which the carbohydrate is stored up by the plant, and in time of need the starch is converted in the plant into sugar (by means of a ferment—diastase) and the sugar once more circulates throughout the structure of the plant. This bears a close analogy to the glycogenic function of the liver in man.

The starch contained in vegetables is a more compact and concentrated form of sugar.

11. Mineral salts contained in vegetables are numerous and potash salts abound most. The great Physiologist, Bunge, alleges this to be the main reason why herbivorous animals do get a craving for sodium salts in the shape of common salt (Sodium chloride).

12. The organic acids, Tartaric, Citric, Malic etc.—contained in vegetable foods, such as fruits are converted into their alkaline salts—tartrates, citrates, malates etc. on combination with sodium and potassium bases, and are excreted in the urine.

They immensely diminish the acidity of the urine and this property distinguishes vegetable foods from animal foods, and is turned to therapeutic account in the case of those suffering from gravel or stone in the kidney or the bladder.

13. There is an extraordinary amount of water present in most vegetable foods than one is apt to fancy; even green peas, lentils and beans which are richest in their solid constituents contain about 75 p. c. of water; while in green vegetables like

cabbages, onions, fruits like melons and papayas, the water may be as much as 90% of their weight.

Now, milk contains about 87 p. c. of water and cabbages or papayas, as we said above, contain about 90 p. c. Hence a cabbage or a papaya is really a more watery food than milk. The apparent solidity of green vegetables is deceptive and is merely due to their cellulose frame work.

It is this wateriness of the vegetable foods that is mainly responsible for their low nutritive value, when compared with the largeness of bulk, and this effect is enhanced by the fact that most vegetable foods do absorb a large amount of water in the process of cooking; while in the case of animal foods cooking tends to reduce their size. It is common knowledge, for example, that one volume of parboiled rice swells up on cooking to about 8 volumes or even more,

The wateriness of vegetable foods, which increases still on cooking is also a great disadvantage to digestion: In the first place the digestive fluids become diluted and digestion in general is thereby slowed or rendered imperfect; secondly, the extreme fluidity of the stomach-contents, as noted elsewhere, hastens the progress of the food from the stomach into the intestines, and the digestion of the proteins, which is mainly carried on in the stomach, is thereby interfered with; the net result is that the absorption of the proteins is very much minimised, and this result is enhanced by the fact that the large quantity of carbohydrates contained in vegetable diet does as a rule prevent the absorption of the proteins.

14. Vegetable foods then, being more carbohydrate are little affected by the gastric juice and their digestion is mainly in the intestines, although part of the starch might be converted into sugar by the ptyalin of the saliva. It is only the proteins that are digested in the stomach.

The bulkiness of vegetable foods and the fact that they contain a large amount of cellulose makes them less readily penetrable to digestive juices and throws a large amount of labour on the digestive mechanism. Animal foods can be said to be better borne by persons of weak digestion than the majority of vegetable foods.

Vegetable foods, further, leave more residue (with the exception of pure sugars) than animal foods, because they are less completely absorbed than animal foods.

We have already seen how this property of vegetable diet is being utilised by Physicians in the preventive treatment of habitual constipation, appendicitis and intestinal toxaemia, which the concentrated animal foods do naturally give rise to by either leaving too little residue or by virtue of the residue being highly toxic.

In this connection it should be mentioned that animal foods are more apt to decompose, and if then taken as food are apt to produce ptomaine poisoning with symptoms of cholera and collapse.

But there are certain vegetable foods such as, white bread, biscuits, macaroni and shreded wheat, cooked cereals like rice, black gram and green gram, potatoes and cauli flowers, which are equally well digested and equally well absorbed as eggs or meat. It is only in the case of foods containing a lot of cellulose that digestion and absorption are less perfect; and unfortunately the majority of vegetable foods correspond to this description. Hence the general proposition that vegetable foods are bulky indigestible and incompletely absorbed,

14. In respect of their nutritive value we have seen that animal proteins are more valuable for tissue repair than vegetable proteins; that starch and sugar, which are entirely derived from vegetable sources, are beyond doubt easily digested and absorbed; and that vegetable fats are as valuable as animal fats.

The question naturally arises, which form of food is better suited to an individual?—vegetable or animal? and an attempt to answer this question raises the whole problem of vegetarianism.

Physiologically for reasons already discussed the vegetarian question is essentially one regarding proteins and proteins alone. We have seen also that vegetable foods are not only relatively much poorer in protein than animal foods, but that what protein is present in the vegetable foods has its value still lowered by its deficient absorption. It must thus be evident that

in order to supply the necessary amount of protein for the daily need, the quantity of vegetable food has to be comparatively larger. The consistent vegetarian should therefore live upon a diet either poor in protein or else consume an excessive bulk of food; the adoption of a poor protein diet is likely to diminish energy and diminish stamina—the power of resistence to disease, and later lead to derangement of the stomach and the bowels.

We have already seen that the amount of Protein required daily by a healthy man doing a moderate amount of work has been fixed at 90 to 100 grammes. But scientific experiments have enabled us to say that it is undoubtedly possible to maintain a healthy life upon such a daily amount of protein as may be contained in a moderate amount of vegetable food. This is fully borne out by the experience of the Asiatic races who are mostly vegetarians. But a **healthy** life is not necessarily an **energetic life**, as most vegetarian races, though healthy, are lacking in the energy characterising the meat-eating races.

Now, energy is not the same thing as muscular strength: a grassfed horse is strong, a cornfed hunter is energetic. Energy is the property of the nervous system, while strength is the property of the muscles; muscles give us the power to do work, while the nervous system gives us the initiative to start the work; muscles do their work upon carbohydrates, which forms the essential characteristic of vegetable food, while nerve-power requires nitrogen, which can be obtained in a concentrated and assimilable form only from animal sources. Protein food, therefore makes for intellectual capacity and bodily energy, and this is one reason that the more energetic races of the world have been meat eaters.

It has been argued against this proposition that the Scottish peasants are endued with a high degree of intellectual capacity and energy. inspite of their diet being purely vegetarian; but this is the very exception that proves the rule; for the Scottish peasant of the last generation was not only fed on a highly nitrogenous food, namely Oatmeal, but further supplemented it by a liberal intake of milk, of which he took sometimes 2 to 3 pints daily. We have seen while speaking of milk that it aids the

digestion of other proteins taken along with it. This same property holds good with other animal foods. It is for this reason that a mixed meat and vegetable diet is considered superior to either a purely vegetarian or a purely animal diet. A purely vegetarian diet as is adopted by Orthodox Hindus is really such a diet, consisting as it does of milk and its products supplementing a diet of purely vegetable origin.

Health and energy are, therefore, possible to be had in immense degree even on a purely vegetarian diet provided that that diet includes a certain amount of pulses or oatmeal and a liberal intake of milk and its products.

Weighing, then, the advantages and the disadvantages of a purely vegetarian and a purely animal diet we come to the conclusion that the **one is as good as the other** for health and energy and increasing the power of resistence of the body to disease.

The scornful definition that "Oats are food for horses in England and for men in Scotland" which we learnt in our school primers has naturally prejudiced us against the food value of this cereal, but today we learn that the same cereal ranks as a first rate article of diet for men who may object to a regime of animal food.

Whatever disadvantages we have noticed of a purely vegetable diet, we must say that the outdoor labourer is not so much affected by them as the one leading a more sedentary life; because the labourer requires a large amount of carbohydrates for his work, which is abundant in vegetable foodstuffs, and from the amount of food yielding the requisite quantity of carbohydrate he is almost sure to derive the necessary amount of proteins also required for his daily needs.

There is another question which is equally applicable to the requirements of the labourer, namely the question of cost. Vegetable foods are much cheaper than animal foods even including fish and fowl and can be easily produced in a Tropical Country like ours and enable cattle also to be reared for our milk supply from the fodder derived from cereals and pulses.

The Indian dietary is largely founded on economic princi-

ples, but from long experience of climatic conditions, religious and social customs and from the fact that Nature yields abundance of vegetable food without much of exertion came to be mainly vegetarian. The Hindus' classification of dietary is based on the principle of the Trigunas (the three Gunas, viz., Satwa Rajas and Tamas). Foods that are sweet, fatty, nourishing and agreeable help in promoting the **Satwa guna** and promote length of life, vitality, strength and health. Foods that are bitter, sour, salted and overhot, pungent, dry and burning promote the **Rajas guna**. These foods are said to cause grief, pain and disease. Food that is not freshly cooked, which is tasteless, putrid and stale, which is of the leavings and is unclean – Such food promotes the **Tamas guna** or dullness. [The Gita.]

Whatever form of diet may prove to be the best for adults, who have greater power of adaptability than children, there is no doubt that in the case of children or adolescents or pregnant or nursing mothers it is safer to adopt a high protein standard, as the risk of supplying too low protein is more formidable.

H. Beverages

1. Water. When water is taken alone or on an empty stomach it almost at once begins to flow into the duodenum, the process going on in repeated gushes through the pyloric orifice, and the time taken by one pint of cold water has been found to be about 40 minutes; with warm water, however, this time is considerably less. This is because heat increases powerfully the movements of the stomach wall and at the same time seems to "unlock" the pylorus so as to facilitate the escape of the fluid; the stomach is, thus, washed clear of its contents as it were. With this purpose physicians often prescribe, in cases of chronic dyspepsia with dilatation of the stomach and in chronic constipation, drinking of one or two tumblerfuls of hot water, the first thing in the morning either plain or with the addition of a few grains of bicarbonate of soda or potash, or at least a pinch of common salt; the alkali or the salt in the water tends to dissolve the glairy mucus often present in the stomach in such conditions, neutralise the acid produced by fermentation of undigested food, and wash out any

overnight remnant of food in the duodenum. In the duodenum it sets up peristaltic movements of the bowels resulting in their free action.

The stimulating effects of hot water on the stomach movements render it a powerful aid to sluggish digestion. Water actually hastens the digestion of some foods by softening them and favouring their reduction to a state of pulp, and this action is increased if the water is hot.

The "unlocking" of the pylorus brought about by hot water explains the immediate relief felt on taking hot water in gastric colic from indigestion.

In cases of pyloric obstruction either from ulceration or cancer, where the contents of the stomach are unable to pass through the pyloric valve the absorption of water into the tissues is prevented causing much emaciation and discomfort to the patient; this deficiency may go so far as to prevent the proper excretion of waste products also and give rise to headache, convulsions, coma etc. from their accumulation in the system. In such cases there is an urgent need to introduce water into the system by some route other than by the stomach, preferably by the rectum, from where the water is readily absorbed into the system.

The rapidity with which water passes through the stomach causes it to be a very dangerous means of carrying infection; for the hydrochloric acid of the gastric juice in the stomach is not given enough time to destroy any disease germs that may be contained in the water. For this reason contaminated water is a more obnoxious cause of disease, such as Typhoid fever, cholera, dysentery etc., than contaminated milk. Hence it is that water more than milk should be above suspicion; but both should be properly boiled before use.

The eliminative function of water is of the foremost importance, and the necessity for a free intake of it is indicated in fevers, gout, diabetes, kidney affections and in habitual constipation. It is, therefore, a great folly and is even dangerous in cases of diabetes, for instance, where large quantities of urine are daily passed, to minimise the quantity of water-intake with the hope of reducing the amount of urine passed. Thirst, which

is the indication for more water, should be the guide, and no water should be spared so long as thirst is present.

Water should always be taken slowly and in sips. Drinking a large quantity of cold water especially when the body has become heated from exposure to sun or heat or is fatigued, has ended in some cases in death by sudden stoppage of the heart.

On the other hand sips of cold water or dashing cold water to the face and chest are useful in fainting fits and collapse by gently stimulating the heart and respiration.

Hot water taken in sips is a good gastric sedative in cases of persistent vomiting from any cause; so also iced water or ice, and quenches thirst.

Warm or tepid water, on the other hand, especially if taken in large quantity, induces vomiting; and is a safe and readily available home-remedy in cases of poisoning. The emetic action of warm water is helped by tickling the throat with the fingers.

In some forms of dyspepsia where there is hyper-acidity of the gastric juice giving rise to a dull sickening type of colic relief is at once obtained by taking in a tumblerful of hot water with or without a few grains of Sodium Bicarbonate in it.

The effect of hot water fomentations over an inflamed part is to allay pain and reduce the swelling and hasten resolution; and if pus has already formed hot fomentations do hasten its coming to the surface, 'pointing' of the abscess as it is called.

A good drinking water should have no colour, no odour of any sort, have a pleasant fresh taste and contain a moderate amount of solid matter (not exceeding about 8½ grs. per gallon); a wholesome water should contain very little organic matter and that too should be of vegetable origin. Presence of a large proportion of chlorides should be viewed with suspicion.

It is generally supposed that very soft water leads to development of rickets from the absence of Ca salts; this is groundless. On the other hand very soft water is apt to dissolve lead from water pipes unless there is even a trace of silica in it, while hard water containing calcium does not dissolve lead. In this way only soft waters can be said to be dangerous.

Frequent use of iced water especially with meals causes indigestion. One may, therefore, prefer water boiled and allowed to cool in clean mud pots and kept covered. This water is both safe and pleasantly cool and refreshing. The mud pot used for this purpose should well be scrubbed inside and placed on fire or in the direct sun for some time before the next fill is made, otherwise a musty odour develops inside the pot which renders the water unwholesome.

2. **Aerated Waters.** These are prepared by charging water with carbon dioxide (CO_2) gas at great pressure, so that there is violent ebullition when the bottle is opened and some of the contents of the bottle are apt to overflow during the escape of the extra gas. The effect of this escape of gas leads to loss of a considerable amount of heat, so that aerated water is always cooler to the taste than ordinary water kept under similar conditions. Hence it is unnecessary to add ice ordinarily to aerated waters, and if one prefers to have them cold the best way is to keep the bottles dipped in cold water or ice before use.

If the water is derived from springs, deep wells and Artesian wells for the purpose of preparing aerated waters it is perhaps of the highest quality.

Pure water impregnated with CO_2 is wrongly called soda water, as it does not contain any soda at all; it is therefore best to name them as carbonated waters or simply aerated waters.

3. **Spring water** is usually pure water and is generally impregnated with CO_2. Some of the springs may contain mineral salts also in addition, such as common salt, salts of soda, of potash, of magnesium, of calcium and of lithium. Mineral waters are medicated waters and useful in the treatment of chronic diseases like Rheumatism, gout, dyspepsia, constipation and some varieties of skin disease.

Hot mineral springs mostly contain sulphur dioxide in addition to mineral salts. These springs are especially suited for the treatment of obesity, gout, constipation and skin disease.

[A hot sulphur-spring having these advantages is situated at Vajrabhai or Vajradevi, 20 miles from Thana, Bombay. The Author visited the place in July 1937; even at that part of the

year when rains usually set in on the west coast of India the water was hot enough and in some parts of the spring-bed the water is said to be nearing the boiling point].

What is known as "balneotherapy" or Spa-treatment is simply this. A Spa is a health-resort having natural springs containing various minerals dissolved in them. Spa-treatment consists in the therapeutic use of these waters by internal use, by baths, douches etc. combined with massage, exercise, climate, diet and general regime. The effects produced by spa-treatment are both physiological and psychical brought about by change of scene and environment, removal from cares of business, family and other worries, recreation and diversion of various sorts. Defective development, chronic inflammations, disorders of the stomach, liver and bowels, toxaemia, gout, rheumatism, mental break-down, high blood-pressure, obesity, diabetes, over-fatigue and brain-fatigue requiring appropriate holiday and recreation are the usual conditions that improve by spa-treatment. Infact any conditions of ill-health, which mainly account for the invalidity and disability of modern life.

In most of these spas there are medical organisations resembling those of hospitals providing appropriate treatment for early and advanced cases.

4. **Mineral water** containing CO_2 in solution is, apart from its pleasant taste undoubtedly an aid to digestion. Indeed it may be said that mineral waters of this type stand alone in this respect among beverages, as they promote the process of digestion by causing an earlier and more abundant secretion of gastric juice; moreover CO_2 acts as a stimulant to the movements of the stomach and thus aids in the mechanical process of digestion also; and the bubbling of the gas through the food contained in the stomach facilitates its disintegration.

But there are cases in which mineral waters or aerated waters are considered harmful. In dilatation of the stomach the mechanical distention of the stomach with gas tends to hamper the action of a weak heart by causing the fundus of the stomach to press up against the heart.

Unfortunately it cannot always be said that aerated waters

are germfree, as CO_2 is not fatal to microbes of disease, except perhaps the cholera bacillus, and that too only when under great pressure. But only water obtained from Artesian wells or filtered through efficient filters may be said to be germfree.

5. **Distilled water** though free from germs and solid constituents has been found to have harmful local effects on the stomach when used alone as a drink especially on an empty stomach.

Sweetened aerated waters such as lemonade, gingerade etc. are apt to disagree with the stomach and produce fermentation and acidity both by reason of the acid they contain and the sugar or syrup. Such beverages, however, should not be supposed to be devoid of any food value, for, a bottle of the sweet drink usually contains about 1½ ounces of sugar, having an energy value of 100 to 120 calories. Their refreshing influence in fatigue or on a hot day is explained by the presence of the sugar and the coolness caused by the escape of the gas on opening the bottle.

6. **Ice.** Frequent use of iced waters or ice cream is supposed to be the greatest single factor in the causation of chronic dyspepsia. The cold contracts the blood vessels of the stomach and prevents the secretion of the gastric juice in proper quantity and curtails the movements of the stomach wall.

Water used for the manufacture of ice should be above suspicion, as, if the water should be contaminated with disease germs there is no guarantee that they will be entirely killed by the cold, although their vitality may be thereby lowered and growth checked. It is for this reason, we said, that if one should prefer cold in his drinks it is much safer to place the drinks in cold or iced water rather than to add ice directly to the drink.

Fruit syrups—prepared actually from natural fruits, not by the addition of synthetic flavours—are very good drinks in the hot weather, supplying vit. C also which overcomes langour of the hot weather.

Tea, Coffee and Cocoa

Tea and coffee are very popular beverages in every country. They contain an active principle—theine or caffeine,

for both are identical—and certain volatile oils which give these beverages their characteristic flavour.

The chief difference between a cup of Tea and a cup of coffee is that tea contains a certain proportion of tannin (as much as one grain in a cup of tea infusion), while coffee contains none.

The varieties of tea are named according to the different leaves of the tea plant from which they are produced; and the proportion of the theine and tannin contained varies in different teas. The theine is so soluble that it is practically all dissolved out of the leaf immediately the infusion is begun; but the proportion of tannin infused varies with the length of time the leaf is allowed to infuse. There is thus less tannin after 3 minutes' infusion than after 5 minutes', and less after 5 minutes' infusion than after 10 minutes'; but beyond 10 minutes' one does not find much increase, for by that time practically all the soluble ingredients have been extracted from the leaf.

From this the practical lesson learnt is that if one wishes to avoid having too much tannin in his tea he should infuse it for as short a time as possible, not more than 2 or 3 minutes in the case of good tea; and if a good tea is infused for not longer than 5 minutes all the theine and tannin extracted will be in the form of theine-tannate, which substance is said to be free from the injurious effects of free tannic acid, but is probably devoid of the ordinary physiological effect of pure theine.

In the preparation of good drinking tea the fault lies oftener with the method of infusing than with the quality of the tea leaf employed. The tea should really be infused, not boiled or stewed as is often done. The character of the water is also of the utmost importance. The Chinaman's rule is "Take the water from a running stream, that from hill-springs is best, river water is the next and well water is the worst." This means that the water should be clean and well aerated (with air or carbonic acid). As prolonged boiling drives away all air from the water and makes it flat and insipid it is necessary that it should have just freshly come to the boil, and if it is already flat it is a good plan to pour the water into a jug from a height (as one often does in order to cool hot coffee or tea), for this causes the water to take up some air again.

The water should not be hard, for the Ca salts seem to interfere with the proper extraction of the constituents of the leaf; nor should the water be soft, as too soft a water seems to extract more of tannin than a hard water. Moderately soft water is therefore, the ideal for making tea.

The quantity of tea leaf is of some importance. The common rule—a teaspoonful for each person and one for the pot—is very indefinite and uncertain; for the weight of a teaspoonful of tea leaf is very variable depending upon the looseness of the rolling of the leaf. For, in the economical preparation of good tea the thorough crushing of the leaf is of great importance, so that the ingredients may be readily extractable. Powdered tea is ideal in this respect and Tea tabloids do deserve a word of praise for the same reason.

The water, then, having been freshly brought to the boil, the empty tea pot should be thoroughly rinsed with this water; the required quantity of the tealeaf is put into the pot while still hot and hot water poured in and the pot kept covered for 3 or 4 minutes; after which the infusion can be strained and poured into another pot (preferably hot also) and this may be kept covered with a "Cosy" till required.

Tea is best infused in porcelain or enamel pot, as, if done in a metallic vessel a metallic taste is imparted to the infusion on account of the action of tannin; and infusing tea a second time from the used leaf should be avoided as such an infusion contains only tannin in excess and no theine, nor the flavour of tea.

Infused tea leaves should not be thrown away but may be used for cleaning teeth or as a manure for rose and other flowering plants. A strong decoction of tealeaves is a good antidote in cases of poisoning by certain alkaloids such as strychnine and digitalin and antimony. Both tea and coffee are devoid of any food value except through the milk and sugar added to them to taste. The Chinaman does not strain his tea and does not add sugar or milk as we do.

The physiological effects of both tea and coffee are identical containing as they do the same active principle, theine also known as caffeine; a warm cup of tea or coffee exerts a stimulat-

ing effect on the heart and chiefly on the central nervous system, and has a tendency to ward off the sense of fatigue and to produce sleeplessness.

Tea was originally valued by the Buddhist Monks of central Asia and Tibet as a drug enabling them to keep awake for their nightly meditation; later on it got into China about the beginning of the Christian Era and from there spread to the West. It is said that tea was first introduced into Europe at the beginning of the 17th Century by the Dutch East India Co. Tea is at present extensively cultivated in India (Assam and Darjeeling) and Ceylon and West Coast in the South.

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The original home of the Coffee is said to be Abyssinia, where it was known about 1000 A. D. Later it was taken to Arabia (from which the botanical name, Caffea Arabica, is derived). Coffee appears to have been introduced into India by the Arab merchants about the 14th Century, and an Arab Saint named Baba Budan actually cultivated it on the hills of the Mysore territory known after the Saint as the Budangiri or Baba Budan Hills. Coffee seeds were therefore first named Budni-beenz (the beans or berries of the Baba Budan Hills) and still retain the name in some parts of Southern India.

The coffee berries are roasted and ground into fine powder which is used to make the infusion—the coffee we drink. French coffee usually contains about 40 to 70 p. c. sometimes of chicory mixed with it. (Chicory is the root of the wild endive, kiln-dried and powdered; the process of drying converts part of the sugar contained in chicory into caramel—a kind of burnt sugar having good flavour and giving the infusion a golden yellow colour). There is no reason to believe that chicory is injurious to health, but its cheapness is a great temptation to use it as an adulterant, a practice which it is said, has tended to discourage the consumption of coffee in certain countries.

The active principle of coffee, we saw, is caffeine, chemically and physiologically identical with theine.

Good coffee is one that is strong and hot; it is prepared by using at least 2 oz. of the powder to a pint of hot water.

Freshly roasted beans retain their flavour only for a short time. The water should be just boiling as in the preparation of tea so as not to dispel all the air contained in it, and the infusion may be prepared in a porcelain, or enamel jug or percolater. Cafe au lait (coffee with milk) contains mostly milk with a dash of black coffee.

* * * * *

The Cocoa plant is the Theobroma Cacao, the fruit of which resembles the cucumber when ripe and contains a pulp in which are embedded bean-shaped seeds. From the roasted beans cocoa is prepared. "Cocoa" was originally "Cacao" but the name got changed with lapse of time into "Cocoa" and has no connection whatsoever with our cocoanut.

The cocoa plant seems to have been introduced into Europe from Mexico by the Spaniards in the 16th Century. Although, therefore, introduced into Europe much earlier than tea or coffee, it is only of late years that it attained any wide popularity, evidently from the enterprise of its manufacturers. The chief ingredients contained in cocoa are:

Fat — 25 to 30 p. c. or even more
& Proteins — 20 p. c.

The chief active principle is theobromine, closely related to caffeine or theine, and cocoa contains about 2 p. c. of it, that is about as much as there is caffeine in coffee.

Chocolate consists of cocoa mixed with white sugar and starch and flavoured often with vanilla. Free use of chocolates gives rise to dyspepsia and constipation especially in children.

* * * * *

The influence of these beverages on digestion is rather unfavourable on the whole; but the tannin and its bad effects are supposed to be neutralised by the addition of a few grains of bicarbonate of soda to the pot. These unfavourable effects are certainly minimised by the addition of milk.

Nevertheless it may be said that in health the disturbance of digestion caused by the infused beverages are practically negligible. But in cases where digestion is feeble these bever-

ages are wholly unfavourable. In such cases tea may be said to be the worst, coffee is preferable to tea, and cocoa, provided most of its fat has been removed in the process of manufacture is preferable to either tea or coffee.

If tea is taken at all by reason of habit a good tea should be preferred, whichever variety contains the least tannin, such as Assam Tea or Ceylon Tea; it should be infused not more than 2 or 3 minutes and should be taken with milk. Only one cup should be taken and that too not on an empty stomach, but only as "after-noon tea".

Tea and Coffee are both to be avoided especially tea as they are all unnecessary stimulants of the nervous system, removing the sense of fatigue and are apt to produce sleeplessness. They are in no sense foods, as they have neither food value nor energy value, but people are generally habituated to their use on account of their mild stimulant effect.

The question to what extent these beverages can be indulged in without injury to health cannot be easily answered with a definite reply. The part played by personal idiosyncrasy and habit is very variable. With many coffee and tea produce wakefulness. Yet there are persons who cannot go to sleep without a cup of tea or coffee at bed time; some may not be affected with even large quantity of tea, but may become ill with a cup of coffee, and vice versa. Such facts cannot be easily explained, and make it impossible to lay down any definite rules regarding the dietetic use of these beverages. But the accumulated effects of tea-drinking or coffee-drinking may be said to be generally for evil on the human system; an unnatural stimulation is produced and is readily followed by an equally unnatural reaction as is the case with all stimulants; and persons of nervous temperament are most likely to suffer from the drink as its effect is to produce in them a general "nervousness;" the person so affected starts, for instance, at the slightest noise or disturbance, and tea-tasters usually describe this condition as "jumpiness." Dyspepsia and palpitation of the heart are very common in them; the dyspepsia results from the astringent effect of the tannin of tea producing contraction of the blood vessels of the stomach and

''tanning'' as it were of the mucous membrane of the stomach; the palpitation, however, is the result of both irritability of heart caused by the theine and the upward pressure on the heart exerted by the stomach distended with flatulence of dyspepsia.

It is certainly a much less easier task to give up the coffee or tea habit than alcohol or tobacco, and the best way to do so is to squarely cut off the drink altogether with a resolute mind; to give up by degrees will be like keeping the devil still at the door and will never succeed. An efficient and safe substitute for these beverages may be found in a cup of hot milk, which combines in it both nutrition and stimulation of a harmless nature.

Cooking

The nerves of taste and of smell are designed to enable us to distinguish good food from bad food, and instead of using them for this legitimate purpose, man often pampers them with highly seasoned foods and drinks, so much so the nerves of taste in course of time become degenerated and come to indefinitely demand the continuance of such foods. The stomach also becomes worne out having to deal with a large amount of food material of a nature quite unsuited for the supply of the real needs of the system. The result is that digestion is impaired and products of imperfect digestion and consequent fermentation do accumulate in the system, rendering it liable to the onset of diseases and disorders like dyspepsia, gastric ulceration, diarrhoea and emaciation.

Cooking improves the appearance of food and develops in it new flavours, and efficiently sterilises it and enables it to keep longer. It also increases the digestibility of vegetable food, and is said to improve the digestibility of meat, possibly by loosening its fibres. On the whole cooking adds to the digestibility of all foods possibly by calling forth a more profuse flow of saliva and the gastric juice by their attractiveness and flavour. Even the thought of savouryfood makes the mouth 'water' and indirectly the stomach also.

We have already seen that cellulose and raw starch are incapable of digestion by the human stomach; cooking softens and

ruptures the cellulose frame work of vegetable foods and gelatinises the starch granules and renders them easily digestible.

Even in very careful cooking a certain amount of loss of the soluble constituents of food during the process is inevitable. In the case of meat the loss is more or less entirely confined to the extractives and salts and water; but in the case of vegetable foods the loss of salts especially is often considerable, but as regards water vegetable foods tend to become richer in water when cooked instead of losing it, as meat does.

Slow cooking. Food being a bad conductor, heat penetrates into it very slowly, and if heat is applied too rapidly to a piece of meat, for instance, the fuel is simply wasted and one runs the risk of over cooking only the outer layers. It is far better to allow a moderate amount of heat to act on the meat for several hours; and the longer the time allowed the longer will be the temperature required.

Various forms of cookers are now in vogue invented with the view of economising fuel consumption and permitting a prolonged action of a moderate degree of heat in cooking. The principle of these cookers is as follows.

The simplest of them are constructed on the principle of a water bath and consist of a double pan, the outer being filled with water, which is kept at or near the boiling point, while the article to be cooked is placed in the inner vessel with a certain amount of water. The heat penetrates slowly to the inside vessel but never reaches the boiling point and all risk of scorching is thus prevented. If the steam in the outer jacket is prevented from escaping it is possible to raise the temperature of the contents of the inside vessel to the actual boiling point.

Some varieties of cookers consist of an outer cylindrical vessel lined inside with non-conducting material like asbestos and felt, and an inner metal cylinder in which the object to be cooked is placed. If it is desired to boil any food, the inner cylinder with the moistened food in it is placed in a saucepan of boiling water and boiled over fire for 5 to 10 minutes; the pan is then removed from the fire, and the inner cylinder with the food is placed inside the outer nonconducting cylinder; the lid of

the outer cylinder is then closed. The escape of heat being thus prevented cooking is allowed to go on slowly for several hours. Even after 12 to 18 hours the food inside will remain steaming hot.

This latter form of cooker acts on the principle of entirely preventing the loss of heat; and just as it prevents any heat getting out, so it can with equal efficiency prevent any heat from getting in. It may therefore be used as a refrigerator to keep ice unmelted quite as well as a cooker. It saves a good deal of time, fuel and care, and there is no fear of food being scorched. These cookers are useful to travellers and campers—out or on occasions where hot food should be constantly in readiness.

Cooking utensils made of copper or brass should be tin-lined as otherwise any acid in the food such as tamarind, butter-milk may easily act on the metal and produce copper poisoning through eating such food.

Preparation of Food and its evolution.

We have seen that the heat applied in cooking food bursting the cells and softening the tissues so as to make it easier to chew is an important aid to digesting raw meat or raw vegetables. It would not be indeed impossible for man to live on uncooked food, and perhaps the nearest approach to this is found among certain aboriginal tribes of the Coral Islands of the Pacific, for example, where raw fish and raw cocoanut form the main part of their diet. Others, such as the wandering tribes of the Australian deserts do eat insects, shellfish, reptiles etc. raw as they find them. The Brazilian forestmen have been known to imitate the ant-bear by poking a stick into the ant-hill letting the ants crawl up along the stick into their mouths.

These practices may ordinarily shock civilised beings, but even the highest of them have no scruples to eat oysters or cheesemites raw, and to this they happen to be accustomed.

But even these rude tribes know how to cook; they had known the use of fire for house-warming and gradually began to apply its use to cooking food. Evidently they must have dis-

covered that cooking softened the animal or vegetable foods making them easier to chew. Indeed the definition that man is a "cooking animal" has no proved exception, ancient or modern; and all civilised nations cook almost every article of food with the exception of nuts and fruits, which they eat raw being more pleasing to the taste.

Eating raw meat or fish has been looked upon as a sign of low culture. The Eskimo is so called because he is a "raw flesh eater" which the word means in French.

The most primitive ways of cooking is seen even now among the savage tribes, who boil their meat or fish on burning logs of wood, or bury them in hot cinders just as we do our nuts or potatoes; later only the oven was invented and in its crudest form was a pit dug in the ground and lined with hard stones. When the stones have been heated by kindling a fire inside the oven the meat or fish is put in and covered with hot ashes. It seems that certain Brazilian tribes set up posts with a grating of branches across, on which they lay their game and fish over a slow fire burning underneath. This is called a "boucan" and it is said the pirates of theWest Indies prepared their store of meat in this way; whence is derived the word "Bucca-neer"(= pirate).

This method of cooking meat is though crude, yet hygienic, as the scorching condenses and chars the outer albumins of meat and forms a water proof covering, inside which the baking and softening of the meat goes on; the flavour and extractives are thus retained to their full extent, and the meat so prepared keeps long without decomposing.

It is interesting to note that the advantages of "slow" cooking were known even to some savage tribes, and in this respect even the civilised cook has to learn something from them; and no better illustration of this will be found than in the method of cooking practised by the Kanakas of the Friendly Islands of Oceania, otherwise called the Tonga Islands near Figi and Samoa. A hole is scooped in the earth and a wood fire kindled and kept burning until a fair-sized heap of glowing charcoal forms; pebbles are then thrown completely covering the charcoal. The substance to be cooked, generally a joint of meat

is enveloped in leaves, placed upon the pebbles and more leaves heaped upon it. The earth is then thrown back into the pit and well stamped down. A long time is of course required for the substance to be cooked through; but so subtle is the mode that over-doing is almost an impossibility. Even when removed after 2 or 3 days the cooked material will be steaming hot and retain the juices, the flavour and the salts. It is said of this method that no form of civilised cookery can in the least compare with it.

The simplest mode of preparation of bread known to mankind seems to have come in with the earliest cultivation of grains and cereals and is still being continued without much change. The meal is moistened with water and kneaded into a dough, which is then spread out thin and baked over a hot iron pan or girdle or in hot embers. Such unleavened bread being first in use the invention of leavened bread followed as a matter of course as the souring or fermentation of the dough made it more spongy and light ("leaven"—lightening). Later on when brewing of ale was discovered yeast from the brewing tub was found to be a better means of leavening the bread.

The other great means of preparing starchy food was by boiling with water, which broke the cellulose covering setting free starch grains to be dissolved in the water. Rice and other food grains were thus used as food after cooking in water to form a porridge.

[In connection with the evolution of the mode of cooking meat it may be of interest to the reader to know how boiled pork came to be the food of mankind. Writes Charles Lamb, the author of Tales from Shakespeare in his humorous dessertation on Roast Pig: "Mankind," says a Chinese manuscript, "for the former 70,000 ages ate their meat raw, clawing or biting it from the living animal just as they do in Abyssinia to this day." According to this manuscript, he says, Ho-ti, a swineherd had kept his swine in a thached hut and had gone out to his fields for work. Before his return the hut caught fire due to carelessness of his idiotic son Bo-bo. Bo-bo fearing that his swine might have been burnt to death touched them with his fingers to see if they were alive. As they were still hot and scalding Bo-bo uncons-

ciously sucked his fingers. Thus it was, it is said, that the taste and flavour of boiled pig was first recognised by mankind. It is said that after this event the method of boiling pork consisted for a long time of setting fire to the hut itself where the swine were kept confined].

Modern civilised form of cookery is, however, advanced so much that there are at present countless number of dishes and sauces, all contrived to please the palate and make one wish for more, but with little heed in majority of cases to their nutritive or hygienic value; and although in this respect the moderners have outbeaten the ancients the main processes of cooking, like roasting, baking, boiling etc. now in vogue still belong to the barbaric stage of culture and retain their prehistoric origin.

"Unfired" Diet

Some eminent people especially strict vegetarians, but who have no objection to taking milk or its products like curds, butter-milk and butter, do advocate the use of unfired foods and thus raise the cry of 'back to Nature.' This looks very plausible at first sight, but a close examination of the question will show the fatal flaw. We have been slowly but surely getting away from nature for thousands of years, and there seems to be no reason for us to revert at this stage of our life to the times when man was inarticulate, was covered with hair and lived in caves or in trees; we have enjoyed a state of civilisation too long to go back to Nature, when there would be no art, no learning, no Science nor any of the amenities that dignify and beutify life; and we have already shown that in the case of fruits and some kinds of nuts it may not be necessary to apply heat to them as then their taste may be spoiled in the case of some at least or their vitamins destroyed by heat, but it is necessary to boil milk, green vegetables and cereals before use, to improve their digestibility and kill any disease germs that might have gained access to them.

Vitamin Contents of Various Foodstuffs*

	Vit. A	Vit. B_1	Vit. B_2	Vit. C	Vit. D
A. Cereals					
Bajra (cambu)	+	+	poor		
Barley	trace	+	poor		
Cholam	+	—	poor		
Buck-wheat (kootu) ..	—	++	—		
Maize	+	—	—	+	
Oatmeal...	—	++	—		
Ragi	+	—	poor		
Rice	—	+	—		
Wheat	+	++	+		
Wheatflour (refined) ..	—	—	—		

All whole-grains are rich in vit. B_1

	Vit. A	Vit. B_1	Vit. B_2	Vit. C	Vit. D
B. Pulses					
Bengal gram	++	+	++		
Black gram	+	++	++		
Cow gram (karamani) ...	+	—	++		
Green gram	++	++	++		
Horse gram	++	—	poor		
Lentil (ಅಲಸಂದೆ ಬೇಳೆ) ...	++	++	+		
Peas (dried)	—	++	—		
Redgram (ತೊಗರಿ)	++	++	++		
Soyabeans	+++	+++	++		

All sprouted pulses are rich in vit. C.

	Vit. A	Vit. B_1	Vit. B_2	Vit. C	Vit. D
C. Leafy Vegetables					
Amaranth	+++	+	+	++	
Brussels sprouts	—	—	—	+	
Cabbage	++	+	—	+	
Celery	+++	—	—	+	
Coriander leaves	+++	—	++	++	
Drumsticks	+++	—	—	+	
Fenugreek (ಮೆಂತೆಸೊಪ್ಪು) ...	++	—	—	—	
Garden cress	—	+	—	—	
Sweet potato greens ...	++	+	—	++	

	Vit. A	Vit. B_1	Vit. B_2	Vit. C	Vit. D
Lettuce	++	+	—	+	
Mint	++	–	—	—	
Parsley	++	–	—	++	
Spinach (ಬಸಳೆ)	+++	+	—	+	+
D. Roots and Tubers					
Beetroot...	—	+	—	+	
Carrots	++	+	—	+	
Colocasia	+	–	+	Trace	
Parsnip	+	+	—	+	
Potato	+	+	++	+	
Radish (ಮೂಲಂಗಿ)	+	+	—	+	
Sweet potato	+	–	++	+	
Yam, Elephant (ಸುರಣ) ...	+	–	++	—	
Yam (ordinary climber) ...	–	+	—	Trace	
E. Other vegetables					
Artachoke	–	+	—	–	
Ashgourd	–	+	—	–	
Bitter gourd	+	+	—	+	
Brinjal	+	–	+	+	
Broad Beans	–	–	—	+	
Milk gourd	Trace	—	–	–	
Cauli flower	+	+	–	++	
Chow-chow	Trace	—	–	–	
Cluster beans	++	—	–	++	
Colocasia stem	—	—	–	–	
Cucumber	Trace	+	–	+	
Double beans	—	—	–	+	
French beans	+	+	–	+	
Kovaikais (ತೊಂಡೆ ಕಾಯಿ) ...	+	+	–	+	
Knolkhol	—	—	–	+	
Lady fingers	+	+	+	+	
Leeks	–	+	—	+	
Jack fruit seeds	–	++	+	–	
Mango (green)	+	—	—	+	
Peas (green)	++	++	—	+++	+

	Vit. A	Vit. B_1	Vit. B_2	Vit. C	Vit. D
Beans (Pink)	—	—	—	+	
Plantain (green)	+	+	++	+	
Pumpkin	+	+	—	+	
Rhubarb	—	—	—	+	
Ridge gourd	+	+	—	—	
Snake gourd	+	—	—	trace	
Sundakai (dry)	++	—	—	—	
Tomato (green)	+	+	—	+	
Turnip	trace	+	—	+	
Vegetable marrow	trace	—	—	+	
F. Nuts and Oil seeds					
Almonds...	—	+	—	—	
Cashew nuts	+	—	+	—	
Coconut	+	++	poor	poor	+
Gingelly seeds	+	—	—	—	
Groundnut or Peanut ನೆಲಗಡಲೆ	+	++	+	—	
Mustard seeds	+	—	—	trade	
Walnuts	—	+	—	—	
G. Condiments					
Chillis, green or dry ...	++	—	—	++	
Coriander	+++	—	—	trace	
Pepper, green	++	+	—	+++	+
Garlic	—	—	—	+	
Ginger	+	—	—	+	
Onion (big)	—	+	—	+	
Onion (small)	+	+	—	+	
Tamarind	+	—	—	+	
H. Fruits					
Apple	trace	+	—	+	
Banana	trace	+	—	+	
Bullock heart (ರಾಮಫಲ) ...	—	—	—	—	
Cashew fruit	—	—	—	+++	
Custard apple (ಸೀತಾಫಲ) ...	—	—	—	—	
Dates	++	+	+	trace	
Figs	—	—	—	+	

	vit A	vit. B_1	vit. B_2	vit. C	vit D
Grapes (Blue)	+	Trace	—	+	—
grape fruit	—	+	—	+	—
Guava	+	—	—	+	—
Jack fruit	+	—	—	+	—
Lemons	—	—	—	++	—
Limes	+	—	—	++	—
Mango (ripe)	+++	—	poor	+	—
Orange	++	+	—	++	—
Pappaya...	+++	—	—	++	—
Pears English	+	+	—	+	—
Pineapple	+	—	—	++	—
Plantains	++	—	—	++	—
Plums	++	+	—	+	—
Pomegranate	—	—	—	+	—
Pomelo	++	—	—	—	—
Raisins	—	+	—	—	—
Strawberry	—	—	—	++	—
Tomato ripe	++	+	—	++	—
J. Flesh Foods					
Beef	—	+	++	—	—
Crabs	+++	—	—	—	—
Eggs	+++	—	—	—	+++
Fish and prawns	+	+	—	—	++
Liver (sheep) ...	++++	++	—	—	+
Mutton	+	++	—	—	—
Pork	—	++	—	—	—
K. Milk and its products					
Cow's milk	++	—	++	—	+
Buffalo's ,, ...	++	—	—	—	—
Goat's ,, ...	++	—	—	—	—
Breast ,, ...	++	—	—	—	—
Butter ,, ...	—	—	++	—	—
Curds	—	Trace	++	—	—
Skim milk powder	—	—	++	+++	—
Cheese	+	—	—	—	—

	vit. A	vit. B_1	vit. B_2	vit. C	vit. D
Butter	++	—	—	—	++
Cream	++	—	++	+	+
L. Other Products					
Cod liver oil	++++	—	—	—	++
Halibut oil	+++++	—	—	—	++
Red palm oil	++++	—	—	—	—

**N. B.—Meaning of the signs used above:*

+ = *contains vitamin*

++ = *good source of vitamin*

+++ = *excellent source of vitamin*

++++ or +++++ = *very high content of vitamin.*

"He that dieteth himself prolongeth his life."

(Ecclesiasticus).

How true are these words! How well worthy of a constant place in our memories! Yet what pains are taken to apologise for a life contrary to these precepts!

PART III

Disease, its Causation & Prevention

PART THREE

Disease, its Causation and Prevention

INTRODUCTION

In the study of all living organisms it is essential to bear in mind that there are invariably two general aspects of the problems connected with them; viz. the living organism itself and its environment; the latter term includes every external stimulus that may impinge upon the body, such as air to breathe, water to drink, food to assimilate and indeed all the general physical and chemical conditions met with on this Earth.

A living organism is said to be healthy, when it is suited to its environment in such a way as to be able to react sufficiently to its demands without at the same time being injured. There is no exact criterion of health, and our idea of health, or rather the phenomenon of health, is based on the observation of a large number of healthy individuals; this conception of healthiness is not a rigid standard, as variations in the direction of either excess or defect may and do occur within certain limits without impairment, however, of health. When the reactions of an individual exceed the normal range we speak of the condition as **'disease.'** Disease is therefore, a failure of normal reaction, either of a temporary or permanent character.

The existence of disease becomes manifest outside by perceptible alterations in the condition of the sufferer and certain disturbed sensations—the **"signs" and "symptoms"** of disease.

Disturbances which attract the attention of the sufferer himself—such as pain, giddiness or nausea—are termed 'symptoms', while disturbances that can be observed by others,—as hardness or swelling of a part or abnormality in the sounds of the

Heart or the Lungs, which can be heard on listening over them—are termed "signs." There is no essential difference between "signs" and "symptoms," as some of the disturbances may be perceptible both to the sufferer as well as to the observer—such as vomiting, diarrhoea, staggering gait, palpitation of the heart etc.

Now, it has been found by experience that signs and symptoms of disease tend to occur in definite groups; in other words, different individuals suffer from similar combination of abnormal, rather perverted vital activities. These groups of symptoms come to form distinct ideas in the minds of observers and each group forms a **disease**, which has a distinctive name given to it. Thus, the sudden onset in a previously healthy individual of pain in the side, high fever with shivering, rapid breathing and perhaps a little cough—all these form a group of phenomena sufficiently characteristic and recurring with sufficient frequency to attract attention, and in course of time this group of symptoms was recognised as a **disease** distinct from other groups of symptoms and received the name of Pneumonia. Further observations showed that in people who died of Pneumonia some portion of one or both the lungs was altered in structure and appeared solid instead of spongy, and this underlying physical condition came to form the idea associated with the presence of the disease, pneumonia.

As knowledge advanced further certain precedent conditions came to be recognised as being **"causes"** associated with this particular disease. Thus, it was noted that exposure to cold often preceded an attack of pneumonia; while, in recent years it has been discovered that many diseases are the effects produced on the body by the invasion into the body of certain minute vegetable or animal organisms, that these organisms grow in the fluids of living tissues and produce poisons—**toxines of disease** as they are called, which are injurious to the structure of the body-cells. Different kinds of organisms invading our bodies are found to be responsible for different diseases.

Now, distinguishing as we have done, the living organism from its environments, we see that the causes of disease may be

roughly: (1) Hereditary, or those arising out of defects in the original constitution of the individual, and (2) Acquired, or those produced by abnormal or injurious external circumstances. Thus, on the one hand a person may be born with gross or minute structural defects rendering some organ of the body incapable of performing its normal function; or certain of his tissues may be defective in that they rapidly degenerate or wearout; on the other hand injury may be produced by external agents such as cold, heat, mechanical violence, poisons taken with the food or the entrance of disease-germs.

These two causes, however, may in some cases interact. Thus, a disease-germ may be **unable** to establish itself in the body and induce disease except in the presence of some hereditary defect in the resisting power of the individual, while those who are the subjects of manifest hereditary weakness may be able to survive if their environments are modified. Thus, premature babies can be reared in artificial incubators, or diabetics may suffer no inconvenience if protected from all possible sources of injury; the hereditary defects consisting in a failure of these organisms to adjust themselves to ordinary external conditions, which, in the instances mentioned are actually injurious.

Now, the tendency for inherited disease exists either in the ovum itself or is acquired by the ovum in the act of fertilisation. In normal development certain organs manifest their inherited tendencies many years after birth; for example, the generative organs both in the male and female develop at puberty and get atrophied as age advances. Similarly, inherited tendencies to disease may not show themselves until a late age in life; for example, cancer generally occurs at late age, say after the 50th year; and cancer of the breast or the uterus appears in the female about the time of menopause, generally after the 45th year.

Possibly in many cases the same unrecognised conditions that induced in the parent the morbid tendencies that are transmitted to the offspring, continue to act on the latter also until the actual disease becomes evident with or without some obvious exciting cause.

We cannot say when this tendency to disease begins, may be

it has been slowly gaining strength for generations; and the fact that a progenitor had not the disease in question and that he or she lived wellpast the age at which such disease usually manifests itself, simply shows that the cause had not acted long enough or with sufficient energy to produce the disease; in fact, it has been recognised that even inherited disease has often its starting point in conditions quite external to the cells of the body.

Now, every individual is the offspring of two parents, from both of whom characters are inherited, and tendency to disease in one parent may either be neutralised by opposing characters in the other parent, or may be reinforced if identical peculiarities are present on both sides.

Feeble vital power without actual disease, may be the heritage of the body or part of the body; and just as certain physiological or personal peculiarities are liable to skip one or more generations—atavism, (or recession) as it is called, so also certain diseases are subject to atavism, e. g., gout and syphilis. Further, certain diseases like Haemophilia (tendency to bleed badly) and some forms of Paralysis appear generally in the male descendents only, although the females may without themselves manifesting them transmit them to their offspring.

Other diseases, which are known to "run in the family" are certain forms of functional nervous disorders like Hysteria, Chorea, Epilepsy and Insanity, which are more or less interchangeable. Cancer of the breast and the uterus generally runs in families. Gout and Tubercular diseases and some forms of eye disorders like Myopia, (especially the progressive type,) night-blindness and colour blindness are among such diseases. One nervous condition, known as Friedrich's ataxy, occurring in the young affects several children of the same family, but is not passed on from parent to child.

Regarding the mode in which disease is inherited, it is in some cases possible that the poison of disease is present in the ovum or spermatozoon (as has been proved by Pasteur in the silk-worm disease); but as to how diseases or tendency to diseases which are not due to any recognised specific poison are transmitted we know no more than how it is that features of the parents are inherited by their offspring.

Diseases, therefore, occurring in an organism or part possessed of normal vitality, must, therefore, necessarily be the result of external conditions, and such diseases are called "acquired" or "environmental" diseases, as opposed to inherited or hereditary diseases.

The chief causes of acquired diseases are:

Mechanical injuries, extremes of heat and cold, alterations in the atmospheric pressure as in high or low altitudes, electric shocks, unclean water, defective food or defective digestion and assimilation of food, starvation, lack of fresh air and sunlight, fatigue and want of rest, mineral and organic poisons and parasitic organisms. The last is the commonest cause of atleast 90 p. c. of diseses of the Tropics.

Disease may be acquired during *intra uterine* life, such as Smallpox, Tuberculosis, Syphilis—the infective agent passing from the mother to the foetus by the blood stream.

* * * * *

The complete healthy life of a cell consists in the perfect performance of all its functions; for this it is necessary not only that its structure and vital energy should be normal but that the nutriment, which it receives should be sufficient and suitable, and that its surrounding conditions—Pressure, Temperature and connection with other tissues—should be normal. Failure in any one of these will lead to defective action, or even death of the cells with resulting disease of the organism as a whole.

In the case of a unicellular organism any change in the external conditions acting on it will affect every particle of its substance and modify all its functions; and any disease affecting such an organism can, therefore, be called a "general" disease. But in the case of the higher animals characterised by multiplicity of cells and differentiation and specialisation of functions any abnormal conditions may act on a group of cells and disturb their functions only without affecting the function of other groups of cells. We thus get what is known as a **"local"** disease. But it is highly improbable in higher animals for any local disease to exist without some disturbances of the system as a whole, though this disturbance may be so slight as to escape notice.

A disease is referred to an organ or tissue during life by its symptoms and by its physical signs; and after death the localisation is justified by the discovery in that part of corresponding structure changes. This is "structural" or "organic" disease.

Diseases in which no visible physical or chemical changes are found are classed as Functional Diseases, under the belief that in them the functions of certain cells are abnormally performed without any visibile structural change. But this conception involves an impossibility as function of an organ or cell is merely alteration in its structure—gross or minute—in response to stimulus; consequently the same structure must under identical conditions always perform the same function. Hence the term 'functional disease' merely denotes morbid conditions of which the underlying structural changes are not obvious or have not been discovered.

The causes of disease are often classified into:

A. Predisposing causes,

and B. Exciting causes.

A. Predisposing causes are certain conditions acting upon the living organism so as to render it **susceptible to outside agents.** Thus, starvation or over exertion may render a person susceptible to the attack of disease-germs, which would ordinarily be unable to settle in his tissues and cause disease.

While discussing the subject of immunity we shall have occasion to consider the mode of action of such predisposing causes, and it is in fact mostly in reference to parasitic diseases that the distinction 'predisposing' and 'exciting causes' appears to have much meaning. But there are other conditions which also come under predisposing causes as they also influence the occurrence of the morbid processes: Thus,

(1) Age—children are particularly liable to catch disease in general as the power of resisting injury or disease in them is not fully developed until the adult age, the condition of stable equilibrium has not been attained, so to say; further, the growing tissues of children are liable to certain affections which do not occur in adult cells, e. g. Rickets. In old age, on the other hand, the vital powers are wearing out and gradual loss of function is

occurring; this is a natural process and does not probably constitute disease, and in old age possibly there is the cumulative effects of causes which have acted for long periods, such as degenerative changes in the blood vessels and in the joints.

(2) Sex—the existence of organs peculiar to either sex renders each liable to special diseases, e. g. Hysteria and chlorosis (one form of anaemia occurring in girls about the age of puberty) do occur in women only; on the other hand, women are comparatively immune to diseases like Addison's disease, Locomotor-ataxy and certain forms of Progressive Muscular Atrophy.

(3) Previous disease and its effects—Some diseases when they have occurred once tend to recur again and again, e. g. Tonsillitis, Rheumatism, Erysipelas, Pneumonia and Pleurisy; on the other hand, to have suffered once from certâin diseases, especially general diseases, like Typhoid, Diphtheria and Small pox practically secures immunity against a subsequent attack of the same disease.

Certain other diseases, again, like Malaria, Syphilis, Gout and Filariasis do modify considerably the functions of the body, and many years after attacks from these diseases it is found that illnesses seemingly at first sight to have nothing to do with them, yield only to the treatment appropriate to the original malady. This is explained by the fact that the causal agents of the original diseases are still latent in the body ready to flare up when the vitality of the body is in some way lowered by external conditions like injury or other influences.

Disease might terminate either by recovery or death. By recovery is meant the return of the part to the discharge of its normal functions; and by death is meant the cessation of all functions. Certain diseases can scarcely be said to have a termination, as when once established they remain stationary, and so long as the cause remains active the disease also continues.

Just as a body placed in stable equilibrium tends when slightly displaced to recover its original position, so also a cell slightly injured tends to resume its normal structure and function. If, however, the injury is too severe the cell dies. So with the organism as a whole; if the disturbance of function is slight

complete health may be recovered, and if the impairment of function is sufficient to arrest its activity necessary for continuance of life the organism dies.

Where the cause of a disease remains active the disease might continue indefinitely and become **chronic.** In chronic diseases the patient's nutrition suffers so severely that his power of resistance to bacterial invasion is lowered, and the bacteria are enabled to establish themselves and finally cause death before the effects of the original malady have reached a fatal degree; such infections are known as "terminal infections."

B. Exciting Causes of Disease

The essential causative agents in something like 80 p. c. of all recognised disease—entities are now known to Science; they are all extraneous in origin, that is, they are foreign to the animal body, in which they produce their harmful effects. This would leave about 20 p. c. of diseases in which the essential cause has not yet been identified. This limited number of diseases (whose causation is unknown) is, however, rapidly diminishing and each year finds one or more of them explained. A certain number of these little-known conditions are comprised in a group or groups variously named as "Constitutional" or "Metabolic" or "Endocrine" diseases. Among these are diabetes, gout, gigantism, myxoedema etc.

Among the 80 p. c. of diseases, whose causation is known, 30 p. c. of the whole are due to **inanimate** agents, physical or chemical in nature, such as injuries, heat, cold, changes in atmospheric pressure, electrical energy and chemical poisons, each one of these causes producing a form of disease like wounds, burns, heatstroke, frostbite, caisson disease and mountain sickness, alcoholism etc.

The remaining 50 p. c of all diseases are due to **external animate** agents such as bacteria, yeasts, fungi, spirochetes, filtrable viruses, protozoa and animal parasites.

Among the same external **animate** agents there is an almost indefinite number of similar but non-disease-producing plant or animal microbes, which are of interest to man from zoological,

industrial and economic aspects; and they help man by enriching the soil by nitrification of manurial and animal matter, causing decay of refuse matter, souring milk, production of alcohol, and in so many other ways, such as even destruction of the pathogenic or disease-producing micro-organisms. Infact, it has been proved by scientists that man could not live on the earth except for the microbes.

There are other forms of these microbes which are neither useful nor harmful to man.

We are concerned here mostly with the disease-producing or pathogenic agents in man.

I. Animal Parasites

Of the animal parasites which affect mankind some are **External** and some **Internal**.

The **External** pathogenic animal parasites common in man are:

A. The Pediculi (lice)—Fig 5.
B. The Acari (itch mites) Fig. 6.

A. Pediculi (Lice)

Pediculi are kinds of lice inhabiting the head, chest and the pubis. They are really insects but without wings, and obtain their nutriment by sucking blood of man through the skin by means of their probosces. Their ova (nits) can be seen sticking to the base of the hair-shaft in clusters of 10 to 15 or more.

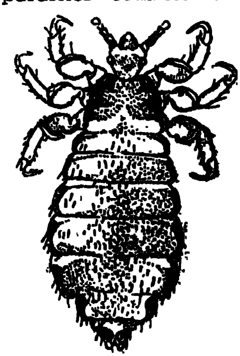


Fig 5
Pediculus Corporis
(The body-louse)
× 20

Heavy infestation by lice by itself brings about a condition known as 'pediculosis' (vagabond's disease). Pediculi produce intense itching by their digging action and give rise to superficial abscesses and enlargement of the superficial lymphatic glands.

The superficial abrasions may be infected by pus-producing organisms.

Pediculosis is a result solely of heavy infestation by lice. But lice have been known to transmit several diseases such as Relapsing Fever, Trench Fever and Typhus. In these cases the transmission is due to infected lice from a patient migrating on to healthy people. The louse on a patient suffering from, say Relapsing Fever, gets infected with the spirochoetes, which enter the body-cavity (of the louse) and get into its circulation. There is a tendency on the part of the lice to leave a person suffering from fever and they get on others sleeping in the same room. As the result of the irritation due to the louse-bite the healthy person starts scratching and thereby may crush the infected louse. The body fluid of the infected louse is full of spirochoetes and the infection is brought about by the inoculation of the body fluid of the louse into the abrasions of the skin caused by scratching. The bite of the infected louse by itself cannot produce the infection, and if the man abstains from scratching he may entirely escape infection.

In the case of the other louse-borne diseases like Typhus and Trench Fever the method of transmission is much the same.

Prevention of louse-borne diseases is effected by "de-lousing" the population. Personal cleanliness, frequent bathing with soap and water and constant change of clothes are useful precautions. In the case of the infected persons boiling or steaming of clothes and underwear, a thorough shave and treating the head and other parts of the body with kerosine or petrol are the most effective remedies. In mild cases application of vinegar to the head loosens the hold of the nits, application of simple oil to the head kills the adult lice by blocking their breathing tubes.

The following is a useful application for "de-lousing":

Kerosine oil	16 ounces.
Sunlight soap	One bar cut into flakes.
Oil of Citronella	1 dram.
Water to —	32 ounces.

Dissolve with the aid of heat and use diluted 1 in 3. (Madras General Hospital formula).

B. The Acari (*Itch mites*)

These belong to the spider-class and are tortoise-shaped. They are about $\frac{1}{60}$ of an inch long. (*Fig.* 6)

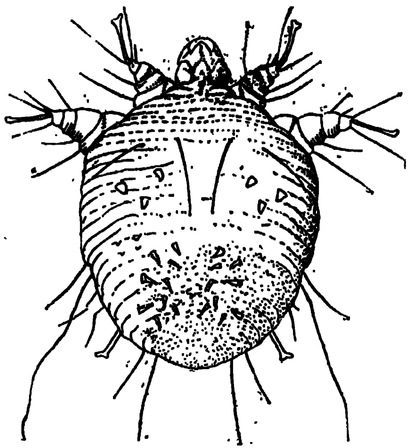


Fig. 6
Sarcoptes Scabiei (The itch-mite) X200.

The presence of this parasite in the skin gives rise to intolerable itching, which is followed by violent scratching. Pus-producing microbes grow into the abrasions of the skin thus produced and give rise to pustular eruptions—scabies (itch). Theparasite seems to have a special preference for the hands, feet and external genitals. The disease arises from prolonged contact with infected skin or clothing or tools.

Treatment consists in thorough washing with soap and application of sulphur ointment and mild antiseptics. The infected clothing should be boiled in order to prevent re-infection.

* * *

The **Internal** parasitic organisms indigenous in man are the so-called "worms" inhabiting in their mature form his intestinal canal. They are: Tapeworms and Roundworms.

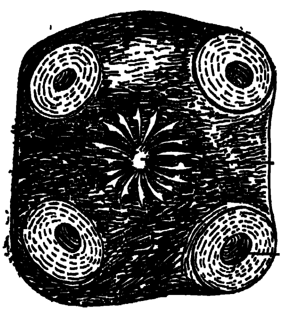


Fig ·7a)
Head of the Tapeworm T. Solium with suckers and hooklets X 60.

A. Tape worms (*Cestoda*)

Are long flat white tapelike worms consisting of a minute head and neck with a longer or shorter row

of attached "segments." The head is about $\frac{1}{25}$ inch broad and is provided with suckers, which enable the worm to cling to the wall of the intestines. Each fully developed segment is a hermaphrodite, (combining the generative organs of both the male and the female in one). The worms are destitute of digestive organs

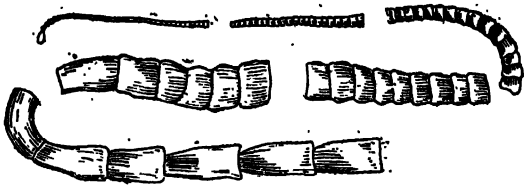


Fig. 7(b)
Portions of T. Saginata.

and absorb their nutriment directly from the intestnal contents of the host.

The life history of a tape worm includes residence in two hosts. The fully grown segments are broken off one by one from the parent worm and the ova which they contain are set free. If at this stage the ova are eaten by some animal capable of acting as the host of the intermediate form of the worm, the ova continue to develop in this intermediate host and an embryo with a few hooklets is set free. By means of these hooklets the embryo is enabled to penetrate the wall of the alimentary tract and by way of the bloodstream or some other route to reach some distant part; and when the progress of the embryo is finally arrested the hooklets

Fig. 7(c)
A segment of the Taenia saginata containing both male and female organ's ×40

disappear and a fully formed head develops, and the parasite comes to be enclosed in a fibrous capsule. This stage is known as the **intermediate** or cystic stage; and the parasite is now known as the cysticercus (meaning enclosed in a capsule). In this state the parasite might live for many months or might soon die.

If, however, the tissues containing living cysticerci be swallowed by an animal capable of acting as the host of the mature worm the investing capsule is dissolved off and the head is set free. Some of these might become attached to the mucous lining of the intestines, when, segments will quickly develop from the free ends. Two months generally elapse between swallowing of the cysticerci and first passage of the segments from the rectum.

Four varieties of Tapeworms are commonly parasitic in man. Three of them are found in the intestines, namely, Taenia solium, T. saginata and Dibothriocephalus latus; and the fourth, T. Echinococcus does not infest the human intestine but is found in its intermediate stage in the human liver and other parts. Each kind is recognised by the microscopic appearances of the head and of the segments. They are several feet long and consist of a large number of segments, except the T.Echinococcus which is only ¼ inch long and consists of only 4 segments.

Their chief host is man, but of the T.Echinococcus is the dog and the wolf, in whose intestine the adult worm is found. Their source of infection to man is mainly through eating of infected pork or beef or mutton ("measly pork" or "measly beef") and lake fish like pike and trout, too insufficiently cooked to destroy the cystricerci present in them.

Effects. The effects produced are generally so slight that the presence of the worm is unsuspected until the detached segments of the adult worm are passed per anum, but, slight intestinal colic and even convulsions and other nervous disorders occasionally ensue especially in children. These effects are due either to mechanical irritation or the absorption of certain toxines or poisons formed by the parasites.

Dibothriocephalus latus is said to produce symptoms of profound anaemia by its poisonous secretion. T. Echinococcus

gives rise to certain forms of cysts (hydatids) of the liver and other viscera. The effect produced by large hydatids is only mechanical, and in the case of the liver they may not cause much inconvenience; but a much smaller growth at the base of the brain may lead to a fatal result.

B. Round Worms *(Nematoda)*

These are long, slender and cylindrical, tapering at both ends. The principal parasitic forms of these in man are:

(1) **The Common Round worm** (*Ascaris lumbricoides*) of the intestine, generally present in children, lunatics and other individuals of dirty habits. As a rule not more than 5 or 6 worms are found in an individual; occasionally however, large numbers may be found in one individual especially in Tropical countries. The ova are oval and generally surrounded by a semi-transparent albuminous capsule; when swallowed they gradually find their way into the small intestines and develop into the mature worm in about a month's time; re-infection from swallowing the ova passed in the foeces may produce a continuous supply of these worms lasting for years.

The effects of round worms are chiefly those due to mechanical irritation giving rise to slight colic, vomiting and catarrhal dysentery and occasionally, especially in rickety children, to convulsions and other nervous disturbances. Some times these worms have been known by their wandering habits to cause obstruction, as of the bile duct causing jaundice, of the stomach, and occasionally the larynx and other places; the matting together of several worms have rarely caused intestinal obstruction and death.

In majority of cases the presence of the parasites is not suspected until after they are expelled in the foeces.

(2) **Thread worms, or maw worms** (*Oxyuris Vermiculares*). These are small round worms $\frac{1}{3}$ to $\frac{1}{2}$ inch in length having the appearance of shreds of bent or twisted cotton. The ova are of a peculiar oval shape flattened like a biconvex lens. The ova cannot develop in the stomach, but can do so in the intestine once they pass the stomach. They must accordingly be passed

per anum of the host and the host reinfected by the mouth before a new generation can develop in cases where any continuous infection is maintained.

The thread worms inhabit the large intestine, where they may exist in myriads. They are found mainly in children and are probably dérived from infected vegetables and fruits especially grown on human excreta as manure. Their principal effects are those of local irritation, producing a large quantity of slimy mucus, some of which is passed with the stools; they may also lead to prolapse of the anus, and anuresis. Certain reflex effects,

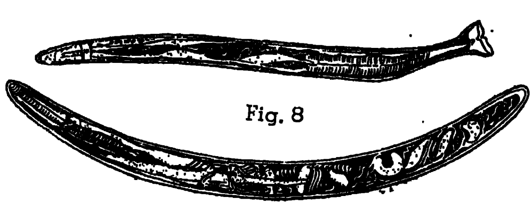


Fig. 8

Ankylostoma duodenale (Hookworm) Adult ×30

like restlessness and convulsions are said to be produced by their irritation at the anus. They make their way through the anus at night causing intolerable itching and may be found in the vagina, on the buttocks and on the bedsheet. The itching at the anus leads to scratching and to the deposition of ova under the finger nails; and the additional itching at the mouth or the nares (which is also a common effect of these worms) leads to the continual transit of the fingers between the mouth and anus during sleep and accounts for the frequency of autoinfection in the case of children.

(3) **Hookworms.** (*Ankylostoma duodenale; uncinaria duodenale*). This parasite is common in all Tropical and sub-tropical countries as warmth and moisture are specially necessary for their propagation. It is sometimes present in colder climates such as the deep mines of Cornwall and Belgium in which high temperature, moisture and bad sanitation occur.

The female worms are rather more than ½ inch and the male ones less than ½ inch in length. The head is provided with four hooks and two teeth. The posterior end is broad in both sexes, the male possessing an umbrella-like caudal expansion fitted with ribs and two long spicules.

The ova are oval, segmented and enclosed in a thin transparent capsule. They develop rapidly in muddy water and in mould especially if this is mixed with foeces, where they liber-

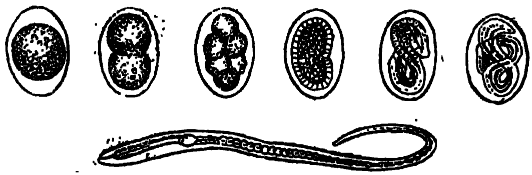


Fig. 8(a)
Embryo and Eggs of the Hookworm ×60

ate the larvae. In this stage the embryos can exist for months. The larvae may reach the alimentary canal of the new host in contaminated drinking water or through the agency of soiled hands or through the deliberate eating of earth. "Geophagi ' is a morbid craving for eating earth and carbonaceous matter which sometimes develops in those infected by all kinds of worms.

Loos has shown that they enter the human host through the skin, generally the soft skin between the toes, causing a sort of itch—ground itch, as it is called. This mode of infection Loos discovered by accident in Egypt, he spilled a culture of the embryo worms on his hand and soon noticed a smarting sensation and actually saw the parasites penetrating the skin. The bare-feet of labourers working in muddy water are quickly attacked. After entry the embryos are said to be carried to the lungs and to pass through the bronchi to the alimentary canal. It is in the intestines that the parasites attain sexual maturity. They take 5 or 6 weeks to form fully developed adults. They inhabit the duodenum and the jejunum in large numbers becoming attached to the mucous membrane by means of their hooks, and sucking the blood from the sub-mucous tissue.

The duration of life of the worms in the intestines was long in doubt, but recent observation in India by Mhaskar in Madras and Chandler in Bengal have shown that a rapid decrease takes place in the number of infected prisoners, who are living under conditions in which fresh infection cannot occur.

The effects of the presence of the worms in the intestines are very variable. In some cases even when large numbers are present no symptoms occur; in other cases the parasite gives rise to bleeding and anaemia—(miner's anaemia) as well as to colic and intestinal catarrh. Children suffer more severely than adults.

Epidemic anaemia was met with in French miners more than a hundred years ago, but it was in connection with a deadly outbreak among the workers at the St. Gothard Tunnel in 1880 that the disease was shown to be due to the ankylostoma duodenale. Important outbreaks have been observed in Austria among brick makers and in recent years cases have occurred among miners in Great Britain. The Geographical distribution, the epidemic or endemic incidence of anaemia, the occupation of the patient, presence of ova in the foeces are useful in the diagnosis of the disease.

An allied parasite—Necator Americanus (American murderer) is responsible for the disease as it prevails in America. This worm is smaller in size than the Ankylostome.

Prophylaxis of Ankylostomiasis or Hookworm disease. The prevention of this disease is, though apparently simple is difficult in practice among the indigenous people of the endemic areas, the chief obstacle being the primitive sanitary habits, poverty and ignorance. From the experience gained in Indian Jails that under proper sanitary conditions the inmates rapidly lose their infection it is evident that proper disposal of foecal matter is perhaps the most powerful method of preventing the spread of infection. Chandler, as a result of extensive investigations in India suggests that European types of pail latrines are unsuitable for tropical indigenous labour on account of their rapid fouling, and recommends more primitive methods as have proved practical in some places in India, such as squatting on bamboos placed 6 inches above the ground over pits or drainage channels.

In Southern India experiments are being made with latrines consisting of deep holes bored in the ground by a special machine and the results are said to be promising; but these deep pits are a disadvantage so far, as the nitrification of the foecal matter is rendered a difficult and slow process, whereby the manurial value of the foeces comes to be practically lost to the soil being placed too deep down in the ground. Hence such pits need not be more than about 3 feet deep; but if they are less than 2 feet the larvae from the foeces will be able to work their way to the surface of the soil in the immediate neighbourhood.

Wearing of boots by the labourers to prevent the access of the larvae to the skin of the foot is advised, but unfortunately the affected class of population is too poor to afford them. Moreover the enforcement of effective sanitary measures has been found to be very difficult even in the best managed estates.

In the West the most serious infections occur in the Tropical Zone, where high temperature and heavy rainfall coexist, The Southern United States, West Indian Islands and the North of South America as far as Brazil and Argentina are places where a serious amount of disability is caused. In the dry portions of South East Asia and dry adjacent North West parts of India the infections are few and the effect of these on the health of the people was everywhere practically negligible (Chandler).

In the Sub-Himalayan divisions of Northern India from the United Provinces to Assam the incidence increases from West to East with the increasing rainfall and humidity and reaches its maximum in very humid Assam, which has six months or more of rain, but with the exception of humid Assam, Burma and Malabar, Chandler found that the average number of worms each individual harboured was rather low and the amount of disease produced was not serious.

The extensive Hookworm Campaigns of the Rockfeller Foundation in many parts of the world have revealed certain facts regarding the percentage of people infected and the degrees of their infestation. The importance of this factor became evident when it was found in the West Indies and British

Guiana that a year or more after treatment most of the patients might have become re-infected, yet the majority showed great improvement in health.

Extensive observations of Mhaskar in the Madras Presidency also showed a high percentage of infections of a very light degree, with an average of about 10 worms in each individual and that this was compatible with good health.

Economic Efficiency and Disability. In very hot humid climates of Ceylon, East Indian and Oceanic Islands, the West Indies and Brazil hookworm infections are serious and cause much disability.

The total disability in the world due to this parasite is thus very great, but it is only in areas in which the climate is both moist and hot with a large amount of rainfall that the most serious infections are common as the larvae do not flourish in the soil which is devoid of moisture.

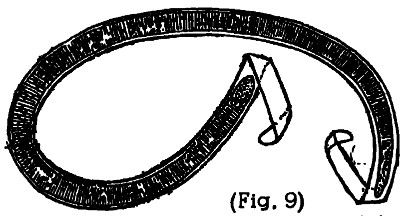
(4) **Trichina Spiralis.** These are minute round worms occurring in mature form in the intestines of man and many animals, and in their immature form in their muscles. Man is infected by eating imperfectly cooked trichinosed pork (principally used in the manufacture of sausages); swine are probably infected by eating trichinosed rats or infected slaughter-house refuse. It is obvious then that no animal can become infected which is not carnivorous.

The parasite is common in America and Germany; its effects are so marked that they give rise to definite symptoms—Trichinosis—consisting generally of two stages: The first stage is characterised by acute gastro-intestinal catarrh due to presence of myriads of embryos in the intestines and is sometimes mistaken for Cholera or irritant poisoning. This is succeeded by a second stage, which develops when the embryos reach the muscles and consists of intense muscular pain, swelling, rigidity and tenderness giving rise in addition to high fever to symptoms of aphonia (voicelessness), dyspnoea (difficulty of breathing) and dysphagia (difficulty in swallowing) and other serious symptoms depending upon the special muscles involved.

(5) **Filaria.** These are long threadlike worms. In Tropical

countries many forms are parasitic in man; of greatest interest is a group of filariae known as the Filaria, Sanguinis Hominis, because the embryos (microfilariae) are found in the human blood, and of this group the Filaria Sanquinis Hominis Nocturna is the best known member. The embryonic forms circulate in the blood and the mature forms lie in the tissues, lymphatics and blood vessels. The adult form of this Filaria Nocturna is known as F. Bancrofti. The adult female has the appearance of a white thread—that is how the name Filaria was derived—and is 3½ inches long and has a diameter about 1/100 of an inch; the male is much smaller and less frequently found. After the death of **the host** these parasites are generally found lodged in the main lymph channels, but may be found anywhere.

The embryos or larvae (microfilariae) (*Fig.* 9) found in the blood are about 1/90 inch long and 1/3000 in diameter, that is nearly the diameter of a red blood cell, so that they are able to pass through the smallest capillaries. The embryo is provided with a fine sheath which it does not completely fill and in which it can move backwards and forwards.



(Fig. 9)

Microfilaria Bancrofti
(Filarial embryo in the human blood. Highly magnified)

The embryos are only found in the superficial blood during sleeping hours—hence the name "nocturna". They appear in the superficial circulation gradually about 6 o'clock in the evening and are present in greatest number about midnight, and Manson has estimated that there may be about 50 millions of them present in the blood of a single individual at that time. They then gradually diminish in number and by 6 a. m. in the morning have completely disappeared into the deeper circulation, the lungs and the large arteries.

During the night some of the embryos might be removed

from the blood by mosquitoes. If the infected individual changes his habits so as to rest by day and be awake at night the parasites also change their habits in the same way. The embryos which thus reach the stomach of the mosquito, pierce and escape from their sheaths and bore their way into the thoracic viscera of the mosquito, where they undergo further development; after this development the larvae pass towards the proboscis of the mosquito. When the mosquito bites --and it is always the female that is the blood sucker and not the male—the larvae are injected as it were into the circulation of the host and the host becomes infected. In the host the larvae develop into the adult form and come to rest into the lymph channels. From this resting place the female discharges her embryos into the general circulation through the thoracic duct.

Manson in 1879 was the first to discover the culex fatigans as the intermediary host of the filaria sanguinis hominis.

In most instances of filariasis no effects are produced, and Manson has shown that in the blood of even a healthy individual 50 millions of them may be present at one time, so that it is possible that in a large proportion of instances of Filariasis no effects are observed. But the commonest effects of filarial infection are;

(1) **Elephantiasis**—an enormous overgrowth of the skin and the subcutaneous tissue of the foot, leg, hands, male genitals, scrotum and breasts and female genitals, giving the part the appearance of the skin of the elephant—Elephantiasis Arabum (as distinguished from Elephantiasis Graecorum or leprosy). According to Manson the symptoms result from some departure from the normal in the life-history of the parasite, such as abortion on the part of the adult female, whereby ova instead of active embryos are liberated into the lymph stream, The ova are much thicker than the embryos and are apt to block the lymph channels at the glands; or again the parent worm itself may obstruct the thoracic duct or may give rise to inflammatory obstruction of that duct.

Elephantiasis is by far the most common manifestation of filariasis. It is most frequent in adult life and in the dark races,

There is a localised inflammation of the skin and soft tissue in the affected regions; the general symptoms include rigors, high fever, vomiting and even delirium, which may pass off after some hours or days with perspiration—Elephantoid fever or Filarial fever. At each succeeding attack of fever the thickness of the part is increased.

(2) **Chyluria**—A condition in which the urine suddenly becomes milky in appearance with a whey like odour. Occasionally it may be reddish from admixture of blood. The chylous urine often coagulates into a jelly after standing for some time, showing the presence of albumen, fat and fibrin, and microfilariae may be recognisable in the meshes of the fibrin. The attack may be accompanied by aching in the loins or interruption of micturition.

Chyluria is believed to be due to rupture of lymphatics in the urinary tract after these vessels have been obstructed and rendered varicose by the adult filariae and their ova. Chyluria comes and goes in the most irregular and unaccountable manner, and cure can scarcely be expected.

Manson recommends rest in the recumbent posture with the pelvis elevated and restriction of fluids and of fat in the food.

(3) **Lymph—Scrotum**—in which varicose dilatation of the lymphatics of the scrotum takes place resulting in the formation of numerous vesicles on the surface of the scrotal skin. The fluid of these vesicles may contain microfilariae.

(4) Varicose lymphatics in the groin from obstruction of the lymphatics by adult filariae affecting generally the femoral and inguinal glands. They form soft and painless swellings over which the skin can be freely moved.

Geographical Distribution. This parasitic worm is very widely prevalent throughout the Tropical and Sub-tropical Zones of the New and Old world. It is especially common in some of the West Indian Islands, such as the Barbados and in British Guiana, in low lying deltaic areas in the East Indies, on the East Coast of India, West Coast of the Madras Presidency and Travancore. It is endemic in some parts of China, in the Coastal area of Queensland, in many of the Oceanic Islands, in some of which

according to Manson-Bahr about 60 p. c. of the people seem to be infected. It occurs throughout Tropical and North Africa with very high recorded rates of infection in Nigeria and Tanganyika and in America from the Southern United States to Brazil.

The incidence of the disease varies greatly even in neighbouring localities, so that very high prevalence in certain areas may occur without a high incidence in the country as a whole.

The endemicity depends upon the presence of mosquito-carriers of the disease and to the existence of heat and moisture in the air; and the racial prevalence noted above probably depends upon the liability to infection through living in close proximity to the infected persons and general unhealthiness of the place.

Prevention—As it is usually those that show no signs of disease who harbour most micro-filariae in their blood the only feasible method of prevention will be the use of mosquito curtain at night; and living as far as possible away from the endemic areas.

Filaria Medinensis (Guinea worm). This worm invades in man the connective tissues usually of the feet and legs and causes a blister, which bursts with the escape of a number of embryos of the worm. Sometimes the adult worm itself in the tissues bursts, dies and undergoes decomposition ending in serious septic inflammation.

The female parasite is about 1/16 inch thin and 12 to 48 inches long and may be visible under the skin as a long thin wavy white band; its uterus is full of embryos, these escape from the blister in the leg of man into water, and then enter certain forms of cyclops or waterfleas, where they undergo further development; when the cyclops are swallowed with drinking water the embryos regain access to the human body. They then make their way from the stomach into the tissues and thus complete their life-cycle.

When the adult female worm reaches the surface of the tissues of the leg there may be aching pain in the affected part,

sometimes there is an urticarial rash on the body in general with vomiting; a blister next forms on the skin where the anterior end of the worm is seeking to come to the surface. Those who have once suffered from the disease can usually say when the worm is nearing the surface, as they then feel a burning or itching sensation at the spot; when the blister bursts the embryos either escape through the opening or the thin transparent uterus is itself protruded; this uterus bursts and allows the escape of a milky fluid containing numerous embryos. When the affected part is in contact with water the uterus is more completely emptied; so that to encourage the escape of the embryos cold water is usually poured over the site of the worm; when all the embryos have escaped, the worm dies and its remains become absorbed, or they may become calcified in the muscles or joints producing rheumatic pains or symptoms of joint affections. But if Bacterial infection has already set in at the blister there may be septic cellulitis with pus formation. When the worm protrudes from the opening as is commonly the case a strong thread is tied to the worm, on which the worm can be wound day by day with slight traction. This is the common method adopted even by the country folk.

Prevention against infection. Infection occurs only by drinking water containing the infected cyclops, and wells and tanks which are approached by steps are the greatest source of infection. No one should be allowed to drink water from there but from draw-wells which are surrounded by a proper parapet to prevent water that has become infected from running back into them. The best method is to introduce pumps for drawing water instead of buckets. Boiling all water before use, after straining if necessary, is the best means of prevention.

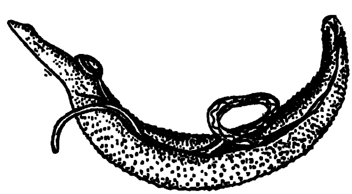


Fig. 10
Schistosoma Bilharzia haematobium. Male and female in copulation × 20.

(6) **Schistosomidae** (Flukes) -- These belong to the class of

nematodae (roundworms). The adults of these flukes are found in pairs in the veins of the portal system and other abdominal veins. (*Fig. 10*). The females produce numerous eggs, which escape from the human body in the urine or the foeces. If the ova reach water free swimming embryos escape from the eggs and attack certain fresh water snails by burrowing into their tissues, in whose bodies they undergo a cycle of development and escape from them in the water, from where they burrow through the skin of persons wading or bathing in the water; they then make their way to the portal system of man where they develop into adult worms and thus complete their life-cycle in man.

Three species of these flukes are parasitic in man: (1) Schistosomum Haematobium of Bilharz, is chiefly found in Egypt, Arabia and South Africa and causes widespread epidemics of haematuria (presence of blood in the urine); the effects of this parasite are to produce pain in the region of the urinary bladder and perineum with dysuria (painful micturition). Ova may be found in urine, which frequently contains blood. Sometimes the ova may lead to formation of bloodclot in the bladder, which might act as a nucleus for the formation of stone in the bladder.

The female worm is rounded, has the form of a thin thread, one inch long; the male is half inch long, of milk-white colour, flat and curved laterally so as to be slightly concave on the ventral side. During sexual intercourse the curve increases, so that the opposite sides meet to form a canal in which the female is enclosed.

The ova are small and in shape they are generally compared to a melonseed being pointed at one end (spiked) and enclosed in a transparent membrane, through which often the elongated embryo can be seen.

S. Mansoni and S. Japonicum are other members of this group—with very similar structures and life histories, only these are smaller than S. Haematobium of Bilharz and their ova present a lateral spike. They infest the colon and rectum giving rise to symptoms of dysentery and sometimes of cirrhosis of the liver.

Historical. The most widely distributed urinary form of the disease, Schistosomiasis, is known to have existed in Egypt even 3000 years ago and Ruffer found the characteristic spiked ova in ancient Egyptian mummies. Bilharz discovered the parasite in 1851 In Cairo; other workers like Manson, Leiper and Looss identified some of the varieties in Africa and the far East.

While the Author was a student in the Madras General Hospital in 1902 under Col C Donovan, I. M. S. of the Kalaazar fame, a European soldier, who had just returned from South Africa after the Boer War, was admitted in the Hospital for haematuria. His urine was centrifugalised and the sediment examined by the author under the microscope, and the characteristic lateral spiked ova were detected. The case was then diagnosed by Col. Donovan as one of Bilharziosis. But in 1903 Manson found similar lateral spiked ova in the foeces of patients from West Indies and identified them as a separate genus, which now goes by the name S. Mansoni.

II. Pathogenic Micro-organisms

(Microbes or Germs of Disease)

For centuries man had lived in ignorance of the causes of infectious diseases; often such diseases spread so rapidly that in a few days or weeks thousands fell a prey to them; and even at the present day, inspite of our improved knowledge about them we see several serious epidemics occurring now and then. In recent years we had the great pandemic of the Post-war type of of Influenza("Flu") of 1918 and we still remember how thousands flew from this planet as the result thereof.

The great difficulty in fighting such epidemics is that even today little is known about the pathogenic germs that cause the infectious diseases and the way how they spread. This is especially true of such diseases as Influenza and Infantile paralysis. Nevertheless the great loss to life caused by such epidemics is becoming less and less in late years, as man learns more and more about germs and the ways of guarding against their attacks.

About 1607 it is that Leeuwenhoek (pronounced Lavenhok) first discovered plants and animals never before known because

they were too small to be seen by the naked Eye and could be seen only by the high powers of the microscope. Their origin was at that time explained by the theory of "spontaneous generation;" that is, it was thought that these microbes grew spontaneously from decaying material and slime in which they were found. Then in 1785 or so Lazaro Spallanzani, an Italian scientist saw a one-celled organism divide, first in two new organisms, each again into two, and so on until they multiplied rapidly. Inspite of the fact that they multiplied in this manner it was still believed that these microbes arose out of the materials in which they thrived so well.

Next in the period of twenty years following the American Civil War of 1860 while the argument about the origin of the microbes was still raging amongst scientists, three great men, Pasteur in France, Koch in Germany and Lister in England proved conclusively that microbes were the cause of certain diseases, and that if they did not gain access to the body disease did not develop. Since then, our knowledge of disease-germs has grown immensely, and although our knowledge about all disease-causing germs is not yet complete we may presume that most of the infectious diseases are caused by them. It is important to learn how we may protect ourselves from the germs and the sufferings they cause. It is by understanding their real nature that we can best combat them.

The germs leave the body of the sick and get into the body of the healthy individual, and under particular circumstances do give rise to disease in the latter. Inspite of all precautions we take, the germs do reach our bodies and get inside them, cause weakness, fever, inflammation, pain etc., which tell us that we are ill. In most cases the body wins in the struggle, the germs are killed and the damaged tissues repaired as well as practicable.

The Infectious diseases are caused by living pathogenic micro-organisms.

They are: (1) The Protozoa
(2) The Bacteria and the spirochoetes.
(3) The Filtrable viruses.

The protozoa are animal parasites and include the malarial

parasite, parasites of trypanosomiasis and kala-azar and of the amoebic type of dysentery and Tropical liver-abscess.

The spirochoetes are more allied to bacteria than protozoa and bring about certain forms of relapsing fevers, ratbite fever and infectious jaundice. Syphilis is caused by a spirochoete.

They will be described in connection with the diseases they cause.

1. Bacteria

These are minute unicellular masses of protoplasm belonging to vegetable class but devoid of chlorophyl and a definite nucleus. They are about 1/25000 of an inch or low or submultiples thereof so that from 5 to 50 thousand of them are required to make a row one inch long, and a single layer of Typhoid Bacilli on a pinhead would contain more than a million bacteria.

In the living condition they are transparent, colourless and refract light strongly and are therefore difficult of detection or identification in their natural state. They have therefore, to be artificially stained with aniline dyes and many of them may then be identified under the microscope by their special staining reactions.

There are thousands of different kinds of bacteria, all to be distinguished by their shape, the results they produce during their growth in various culture-media like broth, agar etc. (cultural characteristics). In form bacteria may be said to follow more or less closely one of two types—the sphere and the rod. The spherical bacteria are called cocci; cocci in pairs are called Diplococci; Streptococci are in chains, Staphylococci are in groups like bunches of grapes; there are tetrads, where they group in fours, and sarcinae in groups of 8 or more arranged like cotton bales.

Bacilli are rodshaped (bacillus means a rod); vibrios are curved bacilli and spirilla are like rods twisted into spirals.

A temperature of 100° C or even 60° C applied for a few minutes will kill most bacteria, but the spore-bearing bacteria (like those of Tetanus, Anthrax) cannot be killed by boiling unless done for **many hours**. Very low temperature inhibits bacterial growth, but might kill them if continued long.

Bright sunlight, especially the ultraviolet rays has a destructive influence on them. Virulence of bacteria is lost sometimes readily, sometimes only after long periods of cultivation in ordinary culture media or by subjecting the microbes to growth in the presence of certain chemicals or at any unfavourable temperature.

All bacteria require for their growth a considerable amount of food material, water and an optimum temperature, usually that of the human body. Bacteria have no reproductive organs and multiply by simple fission into two (Binary fission) and thus continue the species; if there is sufficient food material and conditions of temperature, oxygen and moisture are favourable they multiply rapidly, so much so a single bacterium in 24 hours might give rise to more than 16 millions. They therefore do multiply rapidly in the human body where the blood and the tissue-fluids afford the proper nutriment and the optimum temperature of the body-heat.

Other forms of organisms are smaller and are ultra-microscopic and filtrable (that is capable of passing through the finest pores of a Chamberland filter being so minute; such are the germs of common catarrh, mumps, influenza, small-pox measles and rabies.

Certain bacteria, the socalled higher bacteria come midway between the lower bacteria and the fungi and exhibit specific reproductive structures, thus suggesting that they are probably closely related to vegetable life.

Some forms of bacteria, such as those of anthrax and tetanus, both being bacilli, have the power of protracted survival under unfavourable external conditions, like sunlight, heat and desiccation.

It is important to bear in mind that for the existence of many of the pathogenic (disease-producing) bacteria some animal host is necessary, and except perhaps the resistent spore-bearing forms, they do not survive very long in nature apart from the bodies of animals which they invade.

All bacteria are not pathogenic; and those that are pathogenic cause disturbances of health with the development of

lesions which may be localised or scattered throughout the body.

Certain pathogenic organisms like the typhoid bacilli and cholera vibrios can be present in the body without manifestation of disease; other bacteria such as Bacillus Coli are normal inhabitants of the intesines; all, however, under certain cônditions (to be noted below) become pathogenic, that is, bring about disease.

The popular conception that the presence of bacteria is always associated with disease is erroneous. Human life would have been impossible, as we have seen already, were it not for the innumerable activities of bacteria, which are definitely beneficial; morever, the bacteria found on the exposed parts of our bodies, such as the Bacillus Coli, staphylococci and diphtheroid bacillus are of common occurrence.

The nostrils serve as a filter for inspired air and the bacterial flora found there include varieties of cocci and bacilli; in the throat streptococci and staphylococci are found even in the absence of any obvious signs of disease. The alimentary canal presents a highly complex bacterial flora; in a normal healthy person the stomach is comparatively sterile (free from bacteria) owing to the presence of hydrochloric acid, but the lower intestines contain an enormous variety of bacteria like B-coli, which are present in large numbers in addition to other forms like the bacillus mesentericus and the various spore-bearing bacilli, which latter are concerned indirectly in the digestion of food stuffs like cellulose in man.

The types and number of these bacteria are liable to great variation and to a great extent with the diet. The relative proportions of various organisms are variable and these organisms are compatible with a normal state of health; they are however, **potentially** dangerous, that is, dangerous under particular circumstances of **deficiency of vitality** in the host: e. g. B. coli in the intestine is non-pathogenic and causes no disease, but it may occasionally become pathogenic as a result of imperfect nutrition, exposure to cold, interference with the blood supply of an organ or part of organ and some other conditions in the body

of the host. Under such conditions the B. coli is capable of producing disease, such as inflammation of the urinary bladder, of the peritoneum and other structures in the neighbourhood of the intestines.

Streptococci in the mouth and throat may similarly cause harm and may give rise to endocarditis (inflammation of the inside-lining of the heart) and arthritis (inflammation of joints).

Many other bacteria which occur normally about the body may similarly be potentially pathogenic, i. e. may bring about disease only under the lowered condition of the body of the host.

Pathogenic bacteria mostly live outside the body and then gain entrance into the body of the host. When they reach a suitable place they multiply and produce the specific disease and escape from the body and find another victim.

Most pathogenic germs are not able to live long outside the body of their hosts, as they do not find suitable medium to live on and multiply. Moreover, it is possible that some of them may actually be killed by the non-pathogenic germs contained in decaying animal or vegetable matter.

The majority of the epidemic and endemtc diseases spread directly or indirectly from the diseased individual to another. Hence the most important and most dangerous source of disease-germs are the bodies of persons affected by the disease and also bodies of animals that are ill with diseases that can be transmitted to man also.

In some cases the infected person after recovery from the illness harbours the causative organisms, in which case he is termed a "carrier"; the carrier-condition is often present during convalescence, but it is generally not of long duration, the organism being eliminated or got rid of from the system soon after the individual regains his normal health. In the carrier the germs live in harmony with the host producing no symptoms of disease in him; yet they may still retain pathogenic properties for others. The carrier is, therefore, a constant source of danger to others, and if every carrier carried also the characteristic warning signs of disease, the control of the spread of the latter would have been much easier than it really is.

Bacteria leave the body of the sick in their discharges, the principal discharge depending upon the nature of the disease; those affecting respiratory organs are found in the saliva, sputum and nasal discharges, those attacking the digestive system are quite naturally discharged with the foeces and vomit; some may pass through urine as in the typhoid-carrier. Diseases causing eruption of skin often give out large number of germs on scales or discharges from the sores, and the germs of a few general diseases may be found in practically all the discharges from the body. Some kinds of germs, as of tetanus and anthrax are ordinarily present in road-dust and manure-heaps.

The routes by which bacteria enter the body are various. The commonest infectious diseases like Diphtheria, Tuberculosis and Influenza leave one host and enter into another by the respiratory tract; the sputum or mucus in droplets sprayed out from the mouth and nose during laughing and sneezing contain infective material laden with their specific bacteria; over-crowding and lack of adequate ventilation favour the infection of those, whose powers of resistence are low.

Another group of organisms gain entrance into the body by the mouth, e. g. germs of typhoid, cholera and dysentery. These are chiefly spread by healthy carriers and by flies which feed on excreta and transfer the organisms to our food and water.

Venereal diseases such as gonorrhoea and syphilis are usually transmitted through direct contact between the person harbouring the organisms and the one about to be infected.

Tetanus bacilli can gain entry into the body only through open wounds and not through intact skin or through the mouth; if they enter by the mouth they are either killed in the stomach at once or do not survive there long.

Many diseases like rabies in dogs, anthrax in sheep and glanders in horses are transmitted to man through infected animals. And diseases like malaria, plague, yellow fever, yaws, kala-azar, we shall see later, require the action of some blood sucking insect—vector to transmit their specific viruses from the infected to the healthy.

Now, in order that a particular organism may cause an infectious disease the association of a number of factors have to be taken into consideration; briefly stated they are:

(1) The virulence of the specific organism.

(2) The number of bacteria actually invading the host.

(3) The channels of infection; and

(4) The susceptibility and the power of resistence on the part of the host.

The virulence of an organism signifies its capacity to produce disease by overcoming the natural defensive mechanism of the host. The virulent bacteria have the power of multiplying in the body and to produce toxic substances; e. g. the organisms of diphtheria produce highly potent toxines but do not invade extensively, while the anthrax bacillus is slightly toxic but has a greater power of invading the body.

Infection is most likely to develop when the invading organisms react on the host in large numbers and frequently, and it is for this reason that epidemics of respiratory diseases like influenza originate in thickly populated places; sometimes even a few bacilli of the most virulent type, such as Bacillus of Anthrax may be sufficient to produce a severe infection.

The route of entrance of the infective organism and the vector by which it is conveyed to the host are very important from the point of view of prevention and treatment of infective diseases. The typhoid and the dysentery group of organisms enter by the mouth and the characteristic lesions due to these organisms are found in the intestinal canal, and it has been shown that direct inoculation of these organisms into the tissues is **incapable** of producing the disease. Organisms of diphtheria usually select the mucous membrane of the fauces and the larynx as their primary sites of attack.

Susceptibility of the host exerts a marked influence on the course of the infection. It will be seen later that when disease causing bacteria do attack the human body they produce certain chemical substances or Toxines, which have a damaging effect on the tissue-cells of the body; in such cases some reaction on the part of the host is bound to develop. But so long as these chemical

substances or toxines are innocuous or are helpful to the host there will be no reaction against the invading organism. It is probably rare for the bacteria to be present **initially** in such numbers or to possess so high a degree of virulence as to paralyse completely the natural defensive mechanism of the host. Hence there is always a struggle, (and that is what is meant by reaction) going on between the natural defensive mechanism of the body and the invading organism; the more prompt and efficient the response on the part of the host the better is the outlook or "prognosis" as to his recovery from the disease.

Now, what are the factors that render the host susceptible to the attack of these bacteria? in other words, what are the factors that predispose the host to bacterial infection?

We have seen already - and there is good reason for the belief also—that any agency which interferes with the general health of the host or which damages the tissue of the host will diminish the host's natural power of resistence to infection. Thus fatigue, overwork and want of rest and sleep, chronic alcoholism etc., cause a general deterioration of health; injudicious diet predisposes to disturbances of the alimentary canal and increases the susceptibility to bacterial infection. Injury mechanically opens a road into the tissues and creates a nidus for the growth and multiplication of the invading organisms. Tetanus bacilli do produce disease only when there is an open wound in the skin or the mucous membrane or the tissues.

Infection

We mentioned above that 50. p. c. of all diseases are caused by external animate agents, such as bacteria, yeasts, fungi, spirochoetes, filtrable viruses, protozoa and animal parasites. So it is certain that a large proportion of all instances of disease are infectious in nature, certainly well above the 50 p. c. which we attributed to this source. Infact, Manson has shown that more than 90 p. c. of all Tropical diseases are the result of infection by microbes and parasites.

An infection,—as implied in its Latin origin 'inficere, meaning to stain or contaminate—comprises the entrance into the body

of a host, of an alien or foreign living agent and its manifestations there. We have seen already that no infectious disease is spontaneous in origin, and Pasteur in settling once for all the question of spontaneous generation not only served to orient the question of origin of life but also the nature of infectious disease; in other words "not only does each living cell come from a previous cell of the same kind, but each instance of infectious disease comes from a previous instance of the same malady." There may be an exception to this rule, viz., that a non-pathogenic organism might, as we have seen, under particular circumstances take on pathogenic characters; this, however, does not invalidate the rule.

Living disease-agents, we have seen, leave the body of the host in one of several ways, depending upon their characteristic location in the body of the victim: Thus, (1) the causative agents of Respiratory diseases such as Tuberculosis and Pneumonia are present primarily in the diseased lungs and are discharged through the sputum; (2) the specific bacteria of Cholera, Dysentery and Typhoid fever are discharged with foecal matter; (3) the specific Filtrable virus of scarlet fever, "Flu," measles, cerebrospinal meningitis and some other diseases are discharged with the nasal secretions.

Typhoid bacilli have been known to have been disseminated by the **urine**. **Milk** may serve as a mode of exit of Tubercle bacilli and streptococcus from the cow, and of the organism of of malta fever in the goat. In some forms of septicoemia like bubonic plague, in malarial fever, in filariasis and trypanosomiasis, relapsing fever etc. the respective causative agents are present in the blood, and although under natural conditions infected blood does not serve as a means of exit from the diseased individual, they may be removed by blood-sucking insect-vectors and transmitted to a new host. Sometimes during the post mortem examination of cattle dead of anthrax the spilling of blood on the ground often spreads anthrax bacilli in the soil, where it remains capable of producing new infections for a long time.

Now, bacterial disease-agents may be present not only in those suffering from disease, but as we have noted in those who

have recovered from disease, but still retain the bacteria and may act as "carriers" of disease. Unfortunately carriers do not present active signs or symptoms of disease, and if they did the control of infectious diseases would be much easier than it really is; in fact bacteriologists trying to prevent the spread of any infectious disease have found to their disappointment that persons apparently well may spread disease-germs wherever they go. Thus, persons who have had Diphtheria and Typhoid, and rarely people **who have never** been ill with any of these diseases have been found to be carriers of germs. A cook in New York was known as Typhoid Mary—she was **never sick herself** but she caused over 20 cases of Typhoid before it was discovered that she was the source of the germs. She was therefore compelled to give up her work. **Few years** later she was employed in a hospital where it is said "she caused many more cases of typhoid fever."

Some kinds of germs, as of Tetanus, are present in the soil and manure; being spore-forming bacteria they are able to withstand extremes of temperature and desiccation, and retain the power of multiplication and growth in the body tissues of man and animals when they gain access to them.

The Infectious Agent outside the Host

A life cycle outside the body of the affected host is obligatory in the case of many parasites: e. g. in the malarial organism this life cycle takes place in the insect vector, the mosquito, and in case of the hookworm the life cycle takes place in the soil. This obligatory period "between cases" in majority of the pathogenic bacteria is one of vicissitudes in their growth.

The survival or death of the bacterial agent outside the body of the host depends upon: the length of time that elapses between leaving the first host and the opportunity to reach the second, absence or presence of harmful environmental conditions, such as drying, high temperature, sunlight, dilution with soil or water and, as already mentioned, upon the admixture with other harmless or saprophytic bacteria (that is, bacteria living on decomposing matter of vegetable or animal nature).

Tubercular sputum has been known to retain its infective properties for long periods inspite of desiccation in the Sun, as the presence of the gelatinous matter in the sputum often affords sufficient protection to the bacilli from these influences. Survival of bacteria outside the host depends in some cases on their ability to form "spores," which, as we have seen, are very resistent to the external harmful conditions like drying, heat, sunshine etc.

Entrance of Infectious Agent into a New Host

The simple presence of a disease-germ on the external and naturally protected surface of the body is not sufficient to produce disease; for example, the diphtheria bacillus is frequently seen on the skin, and the pneumococcus in the mouth; and for several reasons a healthy carrier of this sort does not fall a victim himself to the disease for which the germs he harbours are responsible; it may be that he has already acquired a kind of immunity against the particular microbes, or that the microbes have not reached the specifc portal of entry, or, and what is more probable that the individual's power of resistence to disease has not in any way been lowered.

In the case of extremely virulent bacteria such as the plague bacillus or the anthrax, no special portal of entry is necessary, a simple abrasion or a pin prick on the skin sufficient to destroy the protective epithelium will be sufficient for the bacteria to get a point of entrance into the subcutaneous tissues, whence they rapidly invade the lymphatic and blood circulation producing septicaemia (blood poisoning by actual bacteria).

Several cases of "malignant pustule" in man have been traced to the use of shaving brushes prepared from horse hair derived from animals that died of anthrax. These cannot be efficiently sterilised before being marketted on account of the extreme resistence of the anthrax bacilli and their spores even to very high degrees of heat. With less virulent and more selective parasites a specific localisation should be reached before infection can begin. The cholera vibrio, the typhoid bacillus, the pneumoccus and the malarial parasite, for example,

are quite harmless not only on the abraided skin but even if artificially deposited in the subcutaneous tissue. They produce their characteristic effects only when they reach the particular part of the body, such as the gastro-intestinal tract in the case of cholera, typhoid and dysentery bacilli, and the lower reaches of the respiratory tract in the case of the pneumoccus; or they should be deposited by an insect-vector directly into the circulating blood as in the case of malaria, trypanosomiasis etc. The tetanic bacillus and the anthrax bacillus are powerless in the gastro-intestinal tract, but are dangerous when they reach the subepithelial layer of the skin through even a scratch; and it is certain that a mere deposition of the hook-worm larvae on the skin is capable of producing infection of the alimentary canal.

Although as we said, the attainment of a certain location in the body is essential or is favourable for an infection such an accomplishment does not mean a succesful infection, as the microbes have to encounter the various defence-forces of the host, and on the efficiency of these forces will depend the extent and outcome of the infectious process.

In this connection mention must be made of "the mysterious weapon' Herr Hitler threatend the Allies in August 1939, with which according to him the Allies will be unable to successfully withstand. Doubt was raised if this weapon could be bacteria-bombs, bombs filled with strains of virulent bacteria like the Streptococcus and it was asked if under war-conditions of lowered resistence - such as wounds, mustard gas blisters, semi starvation, fatigue etc., such cultures would not produce disease in the form of epidemics. "Man cannot start an epidemic even when he has the bacteria and the means of distributing them" says Dr. Rivers at the III International Congress of Microbiology held at New York in Sept. 1939, "and if he cared it would be a double edged sword killing him as well as the enemy." Scientists doubt also if any live-culture of bacteria can ever withstand the terrific heat of a bomb explosion.

Incubation Period. Let us assume that the invading microbe has reached and passed the portal of entry and is destined through a combination of sufficient virulence on its part

and insufficient resistence on the part of the host to continue its characteristic manifestation. In all instances there is a period of lag—or "period of incubation" as it is called—before the manifestations of infection appear.

Virulent septicoemic infection like bubonic plague, erysipelas have the shortest incubation period; for typhoid fever the incubation is a few days to 2 to 3 weeks; for hydrophobia 2 to 6 weeks; and leprosy requires months or perhaps years before it becomes evident.

In some cases the incubation period depends practically on the rapidity with which the agent reaches the area of manifestation and this in turn on the distance from such a focus of the place of original deposition and entrance of the microbe. Thus, in rabies a bite on the foot requires a long incubation period, whereas a bite on the face, which is nearer the Central Nervous System is followed by symptoms **without much delay.**

The incubation period is perhaps the period required for the microbes for multiplication and production of toxines in sufficient quantity as to give rise to symptoms of infection, and varies with the nature of the microbe and its degree of virulence and the degree of opposition on the part of the host.

The duration of the incubation period depends not only on the location, number and properties of the invading organism but also on the defence-properties of the host; infact symptoms of infection although primarily caused by the action of the microbes are directly due to the reaction of the host; this reaction is not immediate but depends on a "training period" on the part of the cells of the host, in order perhaps to prepare a "bacteria-splitting ferment" as suggested by some.

Course of Infection. The invading microbes, particularly as they multiply in numbers produce a series of harmful effects in the body of the host. They are of the nature of certain mechanical effects such as the (1) blocking of the small blood vessels, as occurs in the blood vessels of the brain in some malignant type of malaria (cerebral malaria); or (2) blocking of the small lymphatics as in Filariasis. Anthrax bacilli have also been known to produce such effects on the blood vessels. But the

commonest form of production of harm is the formation of certain chemical poisons or Toxines; they are produced during the growth of the micro-organisms, or may be due to products of disintegration of the bacterial cells or disintegration of the blood or tissue cells themselves. The nature of these toxines varies remarkably with the nature of the Bacteria that give rise to them and their field of operation.

Area involved in an infection. An infection may remain more or less limited to the portal of entry of the microbes (*local infection*), or it may spread in a variety of ways and to varying extents. Localisation of an infective agent simply means that it is not present in sufficient numbers or virulence to penetrate beyond a limited area, or reciprocally that the defences of the host are sufficient to hold the infective agent in check. This is the case with certain skin infections by low virulent strepto or staphylococci or even with a dangerous organism like the anthrax, which in man may produce only a local malignant pustule without further involvement.

On the other'hand with certain microbes like the diphtheria bacillus or tetanus bacillus the infection may remain limited to the area of the portal of entry, but their toxines might spread throughout the body producing the general fatal symptoms of the disease.

Infection might spread by a process of **extension from the margin,** as in Erysipelas; measles is often complicated by Broncho-pneumonia, which in turn may spread by extension to the pleura without affecting the general circulation. But the usual mode of spread of an infection is by the blood or lymph stream as in Pyaemia, syphilis and some form of Tuberculosis (miliary tuberculosis); sometimes the blood stream itself may allow the multiplication of the bacteria, thus involving the valves of the heart and its lining membrane—the condition is known as septicaemia (presence of poison in the blood) or Bacteroemia (presence of bacteria in the blood) and pyoemia (presence of pus producing germs in the blood).

Typhoid fever is the best illustration of a bacteroemia, where the metastatic foci (spreading centres) are in the gall-

bladder or bone marrow, where they remain for indefinite periods after recovery from active disease.

Mode of action of an infective agent in the body. Once lodged in the body of the host and having multiplied and spread to the extent of its capacity and in a manner characteristic of its intrinsic properties an infection makes known its presence by certain signs and symptoms, which are both local and general.

(1) The most striking local sign is **Inflammation** with its cardinal characteristics of pain, heat, redness and swelling and disturbance of functions of the affected part. Inflammation may occur either simply at the portal of entry or in multiple places where the active agents have collected, and the character of the inflammation depends upon the nature of the bacteria. Thus, the diphtheria bacillus produces inflammation of the fauces with the formation of a fibrinous membrane; pus-cocci produce pus in the inflamed area; tubercle bacilli form the characteristic "tubercles;" typhoid fever is characterised by the accumulation of large mononuclear type of white blood-corpuscles with phagocytic properties.

Now, Inflammation should not be supposed to be evidence of hopeless injury but rather indicative of a more or less succesfully maintained defence mechanism. Even pus, an apparent evidence of destruction and disintegration is composed of discarded cells that have taken part in combating the invading parasite; a vigorous local inflammation at the portal of entry is indicative of superior resistence on the part of the host, and the absence of reaction means an unfavourable prognosis. Low fever in Pneumonia is always indicative of low resistance-power of the patient and forebodes evil.

(2) Among the general symptoms that are the peculiar accompaniments of all infections are **Fever.** The cause of fever in bacterial or protozoal infection is most readily explained by attributing it to liberation of certain split-proteins through disintegration of these alien cells; and these split-proteins are known to be "toxic". It has been found that the protein structure of each of the pathogenic microbes is "specific" and capable of yielding characteristic split-proteins.

The important diagnostic characters in the fever-charts of Influenza, Typhoid, Malaria, Relapsing fever etc., are thus explained. Thus, an intermittent fever at 48 or 72 hours' intervals suggests malarial infection, a fever of six days' duration followed by a remission for six days is generally suggestive of relapsing fever and stimulates physicians to search for a spirillum in the blood.

(3) Another general effect of infections is **fluctuation in the total and relative number of leucocytes in the blood.** Absolute and relative increase in the Polymorphonuclear leucocytes in the blood is the most usual of these changes and represents a positive chemotactic (attracting leucocytes) stimulus exerted by the bacteria. These polymorphos are the most active, though not always the most important defence-cells of the body.

[Normally there are in one cubic millimeter of blood 5 millions Erythrocytes or Red blood cells—devoid of nucleus and 7000 to 8000 Leucocytes or *white blood cells. The white cells are all nucleated. 70 p. c. of the total leucocytes are Polymorphonuclear leucocytes* or *simply Polymorphos, 3 p. c. euosinophiles, 5 p. c. Large mononuclears, 20 -25 p. c. lymphocytes].*

The normal number of leucocytes in one cubic millimeter of blood is 7000 to 8000, and they may rise to even 30,000 or more in "leucocytosis." Such a rise is indicative of an inflammatory focus which may not ordinarily be apparent; in Typhoid fever there is a relative increase of lymphocytes. In diseases where hyper-leucocytosis is the rule its absence is indicative of a bad prognosis regarding recovery.

(4) **Destruction of Red Blood Corpuscles** is common in some form of microbic infection like Malaria, Typhoid fever, Bubonic plague etc.;and in most of such cases there is an **enlargement of the spleen**, which is of diagnostic importance.

(5) In prolonged infections like tuberculosis, chronic suppuration especially of joints, of the pleura and the peritoneum a kind of degeneration (Amyloid or waxy degeneration) of some of the organs does commonly occur and is suggestive of the end of the scene.

There are other numerous infectious agents such as the filtrable viruses of Influenza, Rabies, Cerebrospinal meningitis, which all have a selective action on some of the particular groups of cells, especially of the Brain and the Spinal Cord and their membranous coverings.

Leprosy bacilli have a particular selective action on the sensory nerve-endings of the skin; and the bacterial toxines of tetanus and diphtheria have their selective action on the Central Nervous System.

Complex infections are of two sorts: secondary and mixed infections. In secondary infections one micro-organism follows the action of another owing frequently to lowering of resistence, general or local, produced by the first invasion. Influenza is not infrequently followed by pneumonia, which may be due to any one of the several varieties of microbes, such as the Streptococcus, Pneumococcus or the Influenza bacillus. It is the finding of these secondary invaders that has obscured the causation of many infectious diseases particularly those due to filtrable viruses.

In mixed infections two or more infectious agents are coincidentally present and produce a combined effect, which may be either greater or less than that produced by either alone.

2. Resistence, Tolerance and Immunity

These terms are often used interchangeably but their exact significance is more precise.

Resistence is a more comprehensive term and applies not only to diseases of infectious origin, but to those produced by physical and chemical inanimate agents.

Tolerance is the term applicable only to natural or increased resistence against inanimate disease-agents. Under conditions of tolerance to physical agents may be mentioned the natural mechanisms in the anatomical construction of the body, which places the more resistent skin outward with its nerve endings to warn us of external injuries, the various reflexes, such as sneezing, coughing and vomiting, which tend to expel foreign agents from the nasal, respiratory and alimentary tracts. This type of tolerance may be increased by **repeated irritation**,

as in the case of calluses on the hands of labourers, or the tanning of the skin as in the sunburnt, or acclimatisation to the somewhat unfavourable conditions of the Tropics. A very definite degree of tolerance or habituation to Alcohol, Opium, Cocaine, Arsenic, Nux Vomica and such other drugs may be induced, we have seen by their repeated administration; in this connection it may be pointed out that even unicellular micro-organisms can be habituated to withstand certain concentration of chemicals that would normally destroy them. Habit is so powerful in the establishment of tolerance.

Now, conditions of tolerance to chemical agents should be contrasted with conditions of true immunity, which occur only as a reaction to external animate disease-agents, and tolerance differs from immunity fundamentally in that the properties of tolerance are not transferable by means of the blood serum from the tolerant animal to another, as is **possible** with immunity.

Immunity, then, is the general term reserved for the various and often surprising degrees of resistence to infectious diseases.

Natural Immunity. Many of the states of immunity were matters of common observation not only in civilised but uncivilised people before any use was made of the mechanism involved in such conditions. Various animal species differ markedly in their resistence to a given infectious disease, that is, each animal-species within certain limits has diseases of its own, which seldom extend to species that are very remote It is said that the frog does not suffer from tetanus or most diseases of warm blooded animals. Again, the diseases of birds are peculiar to them and do not occur in mammals; even those characteristic of carnivora and herbivora are separable. Bubonic plague, for example, though common and easily transmissible to rats does not occur in cattle; and tuberculosis, which is common in cattle does not occur spontaneously in dogs or rats. Man as an omnivorous animal has an unfortunate susceptibility both to the diseases of the carnivora and the herbivora, and has in addition certain diseases like syphilis, scarlét fever and measles which are peculiar only to man. In general it may be said that the

variations in species— resistence depend probably on the temperature of the body and the food and the particular enzymes that are active in the host concerned.

A racial immunity is also present in certain varieties of swine and sheep to diseases ordinarily characteristic of these species; but the instances of apparent racial difference, that have been alleged in man are probably not authentic. For example, the fact that the Chinese are resistent to syphilis is probably due to a racial acquired immunity, and that the Mexican is resistent to small-pox is evidently due to their recovery from a disease, (alastrium,) which is quite similar to or a modified form of small pox.

Individual resistence in a given race is also well recognised and may occur in those in the same age-group; e. g. certain diseases like typhoid have a characteristic age-incidence, occurring mostly in the young, and cancer usually in the middle-aged.

Acquired Immunity. It has long been recognised that recovery from certain diseases like Smallpox, Yellowfever, Typhoid and Bubonic plague practically insured the individual against the recurrence of that particular disease: a strong immunity, then, may be acquired by recovery from chance infection, or may be deliberately produced as was probably realised even in antiquity and among certain primitive people. Certain of the African Natives are reported to have used for generation a form of protective immunisation against Snake Venom, and Variolisation (inoculation of the matter from smallpox vesicles) against smallpox was practised in Persia and Greece as early as 11th Century, and probably in China long before that time. It is well known that this method (which consists in producing a pustule in a healthy individual by inserting under the skin or in the nostrils the contents of an active pustule from the diseased) was not introduced into Europe until 1721; meanwhile the method suffered from various vicissitudes partly due to actual dangers that were incurred in the procedure, and was finally replaced by the current method of vaccination introduced by Jenner in 1798.

Jenner was wise enough to recognise that in cowpox we

have a disease which is simply smallpox of man adapted to another animal-species, namely the cow, and capable of producing in man a strictly localised lesion, recovery from which insured him from the more virulent disease, namely, the human smallpox.

We saw above that the most important immunity against an infectious disease is that conferred by an attack of the disease itself. Like other kinds of immunity, however, this immunity is only a relative one, for if through defect of food or clothing, want of rest, overwork or other unsatisfactory condition of life the general vigour of the individual be temporarily lessened he may fall a victim to a disease, which under normal healthy conditions of life he would have escaped. The degree of immunity varies much with the disease as well as with the individual. Thus chickenpox rarely attacks an individual a second time; with several other fevers a second attack is unusual though not rare; whereas one attack of Pneumonia seems actually to predispose to a later attack.

The symptoms of an infectious disease are due in great part to the action of the micro-organisms and their products on the tissues and also in part to the abnormal activity of the tissue cells. These soon succumb if the attack of the parasitic organisms is extremely severe; but if the reaction is less severe an energy, usually dormant or sluggish, wakes up in the tissue cells, and the tissue cells give rise to anti-substances or substances antagonistic to the invaders; moreover, whether these invaders be bacteria, chemical products of bacteria, or other foreign cells or their cell-products the healthy animal-body produces the anti-substance, which is specifically antagonistic to that particular kind of intruder.

These antisubstances are not to be regarded as entirely new productions on the part of the body, but as molecules normally present in the body fluids and tissues. When a foreign cell, such as a bacterium invades the body it soon neutralises the already existing molecule of the anti-substance with which it has specific affinity; but this under favourable circumstances stimulates the cells of the body to produce that particular anti-body in

great abundance, with the result that the anti-substance comes to be present in the blood-stream in excess of the immediate requirements of the body, and in this way immunity is induced. Immunity acquired in this way is called **Active Immunity**; because, it results from the vital activity of the tissue-cells of the person or animal

Vaccination or Preventive Inoculation aims at establishing this variety of immunity and is extensively employed to secure protection against Smallpox, Enteric fever, Cholera, Plague and Hydrophobia.

When serum of an animal which has acquired an active immunity against a certain disease is inoculated or introduced into the body of another animal, the second animal will be rendered **"immune"** to that particular disease. Immunity acquired in this manner is called **passive** immunity, because it does not depend upon the vital activity of the cells of the immunised animal. Passive immunity is more transient than active immunity, and the production of passive immunity is the aim of Serum—Therapeutics.

An anti-substance neutralises the invading agent with which it has a specific affinity by entering into chemical combination with it. Now, in Tetanus and Diphtheria the symptoms are due to absorption of the soluble toxines of the microbes; and the tissue cells secrete into the fluids around them an anti-toxin which is **"specific"** to the particular toxine. Thus, the anti-toxin of Diphtheria unites chemically with the toxine of that disease, and if produced in sufficient quantity prevents the toxine from uniting with the tissue cells and poisoning them.

In the same way the anti-toxin of Tetanus will neutralise the toxine of tetanus.

The serum of animals artificially immunised by repeated injections of the toxines of one or other of these diseases contains the respective anti-toxin, which is employed in the treatment of those suffering from these diseases. Such sera are called anti-toxic sera.

What is known as antibacterial or anti microbic serum is prepared by injecting into animals increasing doses of the

culture containing the specific micro-organism. Such a serum, has, however, been found, as a rule, not to have much curative value, though it may be used as a prophylactic or preventive measure. Among the bacterial sera which have been so far prepared are the anti-typhoid, anti-cholera, anti-plague, anti-pneumococcus and anti-streptococcus. In these diseases, however, the specific microbes do not secrete powerful soluble toxines, which might be employed to evolve corresponding anti-toxins in animals and then provide us with curative anti toxic sera; because the toxines appear to be largely "intracellular" toxins, in the sense of being contained within the bacteria themselves and only liberated when the bacteria die or disintegrate. The immunity that arises in such diseases (whether the diseases are the result of artificial inoculations or ordinary spontaneous attacks) is attributable **not to a single substance like antitoxin** but to a **bacteriolytic or bactericidal agency**, which consists of two elements:

One of these is the specific anti substance, (1) the immune body—developed in the course of the immunising process; the other is normally present in blood-serum and is known as the (2) complement or alexin.

The immune body operates by linking itself on the one hand to the Bacterium and on the other hand to the complement thus enabling the complement to destroy the bacteria.

Unfortunately the complement or alexin is not materially increased in the immunising process; moreover it is unstable and soon disappears when the serum is kept under the usual conditions.

There is still a third process in Immunity; viz., that instead of killing the microbes by the agency of the Immune body and complement, the anti bacterial serum of an immunised animal may operate by increasing the susceptibility of the microbes to the action of the phagocytes. Thus, Sir Almroth Wright has described under the name of Opsonins (meaning purveyors) bodies which are normally present in blood serum and have the property, not of directly destroying bacteria, but of sensitising their protoplasm in such a manner as to render them (bacteria) a more easy prey to phagocytes.

The varieties of antisubstances that are evolved in the course of immunisation may therefore be said to be of the nature of:

(1) Antitoxins.

(2) Bacteriolytic bodies—

(a) Immune body.

(b) Complement (alexin).

(3) Sensitizing bodies—or opsonins.

All these are normally present in blood serum.

Some antibacterial sera when added to living cultures of the particular organisms with which they have specific affinity, cause the bacteria to clump together—This clumping (agglutination) is due to an anti-substance known as '**agglutinin**' present in serum.

Agglutination is met with in connection with Enteric, Cholera, Maltafever, Plague, Tuberculosis and Bacillary dysentery. It is often taken advantage of for diagnostic purposes, as in the Widal's Test for Typhoid fever and in the corresponding test for Malta fever.

Theories of Immunity

(1) **The Phagocytic Theory.** The important discoveries of Pasteur led to practical results of great significance, and more important still, they led to speculation as to what could actually take place in an immunised animal; and both Pasteur and Koch made suggestions as to how the protection against infectious agents actually occurs; but those suggestions were later abandoned, and it remained for a Russian Zoologist, Eli Metchnikoff, in 1882 to develop the first completely adequate and still important reason for the resistence of the animal body to disease. Metchnikoff proved that certain cells of the body, first of all the Polymorphonuclear leucocytes (microphages) of the blood, and secondly certain mononuclear cells(macrophages) not only in the blood but in other tissues were the chief agents of defence, as they had phagocytic or devouring properties, that is to say, of ingesting and destroying bacteria and other foreign cells. In his mind the microphages (polymorphos) were

primarily those most concerned in the acute bacterial infections; and the macrophages (mononuclears) played their role largely in the disposal of foreign animal cells, which, incidentally included polymorphos also that had succumbed in their struggle with bacteria. But in recent years we have come to regard the macrophages, the distribution of which in the body is much wider than at first supposed, as even more important than the microphages. Their importance is evident not only in protozoan or animal cell-infections, but also in the acute bacterial infections, where they seem to serve as the second line of defence, in instances where the microphages are inefficient; in other words macrophages can dispose of bacteria that are too virulent to be checked by the microphages.

The macrophages, or the mononuclear leucocytes have three main distributions in the human body, namely in the connective tissues, in the endothelial capillaries and to a less extent in the bloodstream, and there is evidence that one form present in any of these areas may be transformed into any other varieties. Where these cells are collected, as they are in the granulation tissue of a healing ulcer, they not only serve to protect such tissue locally from even virulent agents, but they can actually move within certain limits in response to an infection in some other part, as for example, from one pleural cavity to another.

Metchnikoff's conception of production of immunity has been universally accepted not only in its essentials but in details too. It will be seen that the part played by the more recently recognised Reticulo-Endothelial-cell-system tends to strengthen the significance of the phagocytic theory.

[**The Reticulo-Endothelial System** (R. E. S.) Widely scattered in the blood and tissues of man and higher vertebrates there are certain cells of the large mononuclear (macrophages) type that possess the powers for phagocytosis and intracellular digestion. These take up all foreign particles, whether they be inert, colloidal, inanimate or animate, (bacterial or protozoal) and drugs and dispose of them in a manner best suited to the body economy. These cells go collectively by the name, Reticulo endothelial system. Metchnikoff's

macrophages and Mallory's "endothelial leucocytes" are now recognised to be reticulo-endothelial cells; and these workers may well claim to be the first to recognise them and point out their importance. Various other workers had met with these cells under various circumstances and referred to them under different names. In 1913 Aschoff (an American) and Landau proposed to group these differently named cells into a single system (R. E. S.) In 1924 Aschoff gave a detailed description of the anatomical distribution of the cells composing the R. E. S. and pointed out their functional unity and stressed their immunological importance. The R. E. cells have a very wide and scattered distribution throughout the body. They are found in the spleen, liver, lymphoid tissue, bone marrow, connective tissue, blood and endocrine glands. The R. E. system is concerned with blood destruction also].

2. **Humoral theory of Immunity.** Soon after Metchni-Koff's theory of phagocytosis was outlined various German observers began to record a series of investigations which indicated the presence in the fluid-elements of the blood serum and plasma of properties which are destructive for bacteria. This theory does not much differ from what we have already outlined above.

Both the phagocytic and the humoral theories can be said to be inter-related to each other in as much as the attraction of the Phagocytes to the seat of infection is entirely dependent on what is known as the chemotactic effect of the microbes themselves.

3. The Natural Powers of Protection of the Body

We have discussed in the foregoing pages the natural powers of resistance of the human body to the attacks of microbes of disease and have seen that the efficiency of the protective mechanism determines the difficulty with which disease is produced or the susceptibility of the host is increased, and that these defences of the host are:

(1) The protective coverings of the exterior of the body, viz., the skin and the mucous membranes. These are barriers

to the majority of the micro-organisms, but a slight injury may, however, permit the entrance of the microbes through these natural barriers; while some of the filtrable viruses can even penetrate the intact skin.

(2) Antibodies which neutralise the toxines of disease, injure or destroy the micro-organisms and prepare them for phagocytosis. In addition there are ferments and tissue-fluids, which may destroy micro-organisms and digest them as well as the products of disease.

(3) Phagocytes—The Leucocytes and the Reticulo Endothelial cells,—which may ingest and destroy the microbes. In most instances the antibodies are necessary to prepare the bacteria for phagocytosis. Inflammation consists in the attraction of the phagocytes (chemotaxis) to the seat of irritation. Inflammation is always followed by repair.

In addition to these, there are other factors which help the body in warding off disease or injury.

Physiological Factors. (1) The protective action of the various secretions of the body which are discharged on the surface. These secretions abundant along the mucous membranes not only mechanically wash away the microbes and their toxic products but also restrain their growth and kill many of them. Thus, the ciliated epithelial lining of the mucous membrane of the nose, the larynx, the trachea and the bronchi and the genital organs and passages in the human body, has its peculiar protective properties against foreign irritants of any sort (including microbes). The nasal passages serve not only to warm and purify the inspired air breathed through them before its entry into the lungs but serve to mechanically filter it, through the hairy nares, and the mucous secretion arrest the particles of dust and other foreign bodies including microbes of disease.

(2) The skin and the sensory organs are the sentinels of the body; we have seen that the skin is very resistant; on that account nature has placed it outermost in the body; its delicate sensory terminals warn us of injury from outside. Having the power of regulating our body-heat the skin is capable of adjusting itself to varying changes in the external temperature and to

atmospheric pressure through its elasticity; when injured in the daily struggle for life the skin produces immunising substances and in this respect is a most important organ; and any irritation acts in large part by calling up the immunising powers of the skin. The skin should, therefore be kept in good state by daily massage and exposure to sun and open air. The glow and fine texture of the skin of a warrior or of a race horse are proverbial.

Sunburn is a superficial injury and is quickly followed by repair.

(3) Certain physiological reflexes, like winking of the eyes, sneezing, coughing, vomiting and even diarrhoea are all attempts of Nature to guard against foreign invasions. A mote in the eye is washed out by the increased flow of tears it sets up, irritants entering the nose cause sneezing, and a foreign substance inhaled into the larynx or wind pipe is got rid of by coughing. Even the sight of unwholesome food causes retching and if taken into the stomach causes vomiting; and an undigested fermenting mass of food in the stomach is got rid of by vomiting or purging. The virus of cholera gaining entrance into the alimentary canal sets up vomiting and purging with large watery stools, indicating the means Nature adopts to wash out the irritating element.

Endless are the physiological actions coming into play both in health and disease, all calculated towards ensuring safety to the body. A few more examples may be given: such as the clotting of blood which helps in sealing the cut ends of a blood vessel; or the secretion of a large amount of fibrinous material in and around a leakage in the bowels as in the case of a perforating typhoid ulcer, with the object of either sealing it or shutting it off from infecting the general peritoneal cavity; or compensatory hypertrophy of the heart in case of valvular disease of the heart etc. A foreign body lodged in the tissues sets up inflammation and suppuration and the body is thrown out when the pus is discharged; or as sometimes happens in the case of an aseptic body like a fired bullet lodged in the body, Nature attempts to enclose it in a fibrous capsule (encystment) formed around it. Often a tuberculous cavity in the lung heals by the formation of

such a fibrous capsule all round it so as to shut it off from the healthy portion of the lung and save the latter from infection.

Next we have to take into consideration the natural protection afforded by the anatomical formation of various cavities of the body with their lining of tough serous membranes, in which the organs are mostly lodged for their safety. These are the bony cavities of the skull and spinal canal lined with the meninges in which are placed the most vital organs, the Brain and Spinal cord; the special sense organs, the Eye and the Ear, are like wise protected from violence from man's natural weapon of offence or defence, viz. the fist. The Lungs and the Heart are enclosed in the pleurae and the pericardium respectively and placed securely in the thoracic cavity—an elastic casing formed by the spine behind and the breast-plate in front, the ribs at the sides covered with thick layers of muscles of the chest and back and the elastic thick, muscular diaphragm below; so also are the organs of the abdomen and the pelvis, mostly enveloped in the peritoneum and secured to the spine behind and placed in the abdominal cavity formed partly by muscular and partly by bony structures.

In addition to affording support to their contained viscera and saving them from shocks or jarrs, the serous membranes are actively also concerned with combating disease-organisms through their lining of endothelial cells, which, we have seen, have the power, like the other cells of the R. E. system, of phagocytosis, and phagocytosis is the most effective means of dealing with disease-microbes.

It can, thus, be said to be established beyond doubt that all life is endued with a vital force, which enables the body to adapt itself to change of environments and ward off untoward influences, and that all tendencies of nature are towards growth and towards health, in other words, **it is as natural to be healthy as to be born.**

Physiological Adaptation

There is a striking contrast between the durability of our body and the transitory character of the cell elements of which it is composed, and the human organism lasts longer than if made

of steel. Not only does it last but ceaselessly overcomes all difficulties and dangers of the outside world. That is to say, it "accommodates" itself to the changing conditions of its surroundings; it persists in living despite physical, economic and social upheavals, and seems to "mould" itself to changing circumstances. Its organs, moreover, improvise means of meeting every new situation and its physiological processes always incline towards the longest survival of the individual. This strange function is called **adaptation** and makes human existence possible with its special characters. Hence, whatever our sufferings, our joys or the agitation of the outer world may be, our organs do not modify their rhythm to any great extent; and their tranquility which is assured by the converging efforts of the body functions is never perturbed by environmental changes.

4. Vital Force and its Conservation

Probably no subject connected with preservation of health or prevention of disease is at once so important but at the same time so little understood as the conservation of our vital forces. We are all aware of the importance of having a good sum of money in reserve with a Bank, as the relations of man to man in these days of civilisation are such that money is practically indispensable to accomplish our purpose in life; and vital force is of no less importance in the physiological domain of man's existence. But there is this difference: one can easily know whether in the case of a Bank more money is being deposited than is being with-drawn, or can know if perchance the drafts have been in excess of the deposits. Not so in the matter of transactions with the Bank of Life. The human organism, we have seen, is largely a self-regulating machine and is so constructed that if excessive drafts during youth and middle life are made upon the vital forces a corresponding provision is also made by nature and the required amount of vital force is forthcoming; moreover, no explicit sign is given the individual that life's forces are being withdrawn and that the drafts on the Bank are in excess of the deposits.

Now, the sum-total of the vital force of each individual

depends upon the amount of vigour which he has inherited from his parents and also upon the temperateness and the kind of life which he leads. We are often surprised to hear that men esteemed to be robust and vigorous succumb to death even after a slight illness; while men who have been ailing from childhood and never robust or enduring, but who have been naturally obliged to take proper care of their health and to guard against unhealthy influences usually continue the battle of life even to old age. The explanation is easy. These robust people who succumbed so easily to disease have been accustomed in early life and perhaps for years to issue far greater drafts on the Vital Bank than they had made provision for and have constantly on that account been running short of their stock of vital force; so that when subjected to a severe trial physical bankruptcy and death ensued. Unfortunately as we have seen, the self-adjusting mechanism of the body does not give any signal of alarm, the greater the draft apparently the greater the supply.

The means by which man overdraws his surplus of vital force are many; such as exposure to cold, fever and anxiety, overeating and starvation, over-exertion and want of rest and sleep and over-indulgence in stimulants and sexual excesses.

We see people. apparently in good vigour accustom themselves to only a few hours' sleep during the 24 hours of the day, devoting the rest of their time to doing two days' work in one day. Owing to the wonderful provision of nature just referred to, apparently the more such a person demands of the organism the more there is at hand to respond. It is therefore quite possible that one in vigorous health may even for years habitually sleep one, two or more hours a day less than nature demands, or work for 6 or 8 hours more than is natural and wholesome, and still apparently be in good health. But when the day of reckoning comes or the poison of an epidemic enters such a system, there is not enough of vital reserve left to expel the intruder and in consequence collapse and death ensue. The individual himself or his friends have no suspicion of what the real cause of the break-down was. Quite possibly another member of the same family may be exposed to the same infection but either does not

have an attack, or if attacked is able to ward it off easily and make a quick recovery. A thoughtful person will easily see that where two are exposed to the same infection under the same environmental conditions that the one escapes with little or no harm, while the other succumbs, the reason is that the one has a large reserve of vital force and that the other has none, having overdrawn his account.

Whoever habitually therefore deprives himself of the natural amount of sleep and rest is lowering his stock of vitality, and the same is true of any one who indulges in overwork or any of the stimulants like alcohol, tobacco etc. or in sexual excesses, as all excesses are a distinct drain on the nervous system and on the vital force. Sexual Intercourse meant so much expenditure of vital energy which, though it is refunded almost atonce, soon loses its primal excellence. We see this primal excellence in many great souls (mahatmas) who retain the qualities of youth up to a hundred years or more. Strict celibacy is the only important means of conserving vital energy.

In fact indulgence in sensual pleasures of any sort adds to the appetite for it and all one's honesty of purpose and sense of duty have not the power to check the expenditure of his mental and physical energies in the pleasure of a moment.

Exercise in moderation and up to the needs of the system is a most important and indispensable requisite; but contests in athletic sports conduce to overstrain, and many a young man have come to premature death from an excessive indulgence in those sports, while many more have permanently injured themselves.

Students at Colleges and Universities do sometimes indulge in athletic contests and unconsciously damage themselves thereby; and may have still a store of vitality sufficient to enable them to work for their Degrees. But the sum-total of these excesses made up of under-sleep, overwork, improper and untimely meals, smoking habit and other indulgences constitute the cause of their premature death; it is well said that "they dig their graves by "**Degrees.**"

Physiologists maintain that the natural life of man is 100

years or even 120 years; but the fact that about 55 or 65 is now considered the full span of life indicates that the race has become so deteriorated that there is a deficit of full sixty years even in the case of those who have escaped the mortality of childhood. This deficit is the result of the various strains and excesses that abound on every side in the civilised world.

Fear and Anxiety are distinctly a strain on the nervous system and a drain on the vital forces; so also anger or rage. Instances are not rare where their effects have been so great as to produce even sudden death. One of the advantages claimed for the so called "mind-cure" or Christian science is that it allays fear and therefore cuts off one source of drain on the vital force.

Starvation and improper food do act by cutting off the food itself of the vital force. Overeating, like drinking and smoking and such other habits, is as universal as the human race and is distinctly harmful and involves a heavy drain on man's vital powers.

Indulgence in passions is another fruitful source of "diminished vitality, crippled usefulness and shortened life;" and unfortunately the victim is not conscious that his powers are being under-mined, but there are abundant proofs that it is true notwithstanding.

Scientists maintain that the pursuit of pleasure for pleasures' sake wherein any physical act is involved is not lawful and violation of this law always results in a greater or less diminution of the powers of life to withstand disease; and if one day mankind be persuaded to refrain from indulgence in the sexual relation except for the purposes of procreation, half of the ills of flesh would disappear from our planet, and an amazing improvement in greater freedom from nervous diseases and, in fact, from all diseased conditions would be at once manifest.

This list could be further extended, but it is hoped that enough has been said to impress on the thoughtful reader the great importance of this subject, and that because there is no daily record of the damage done to the system by overwork, overeating, sexual excesses, insufficient sleep, by the use of stimulants and narcotics etc., it does not follow there has not

been a daily deterioration of the natural forces of the individual. Indeed there is abundance of evidence to prove that such deterioration is inevitable. Thousands of persons, now occupants of mental hospitals, and tens of thousands who are suffering a living death of gloom and melancholy because of a debilitated nervous system, are the victims of the various habits, excesses and dietetic errors.

III. Control and Prevention of Communicable Disease

To recapitulate what we have already seen regarding the causation and the mode of spread of infectious diseases which are transferred from person to person or from animals to man:

Modern science has shown that communicable diseases are caused by definite and specific microbes (Bacteria, protozoa and spirochetes), many of which have been isolated and the manner of their transmission from host to host determined. In many diseases although the causative organism has not been isolated its existence is inferred and the manner of its transmission surmised from the characteristics of the disease.

It has been established beyond doubt that infectious diseases never arise spontaneously, but that the causative organism is always derived from a previous case of the disease. The mere presence of organisms does not however, always produce the disease. Indeed, disease-producing organisms are often present in a person who shows no signs or symptoms of the disease because of the immunity towards it, but such an individual may serve as a "carrier" and transmit the disease germs to people who are not immune, with disastrous results. Thus, we find all degrees of severity in the disease produced by pathogenic organisms, and the most severe symptoms often accompany the disease in one person infected by the same organism, which in another produces scarcely any effect. We must conclude, therefore, that the spread and continuance of disease is possible:-

1) By those who carry the germ without showing any symptoms of disease,

2) By those who show symptoms that are so mild or so

atypical as to prevent recognition even by experienced observers.

3) By individuals during the stage of incubation,

and 4) By persons suffering from the fully developed form of disease.

The actual transmission of disease is accomplished in a number of ways. The causative germ may be shed off in the excreta of a patient as in typhoid fever, in the secretions of the respiratory tract as in diphtheria and scarlet fever, in the sputum as in Pulmonary Tuberculosis, or from sores as in the case of venerial disease and small pox. When the microbes exist in a free state in the blood they may be transmitted by bloodsucking insects, as for example, the transmission of the malarial parasite by the mosquito.

Material carrying the germs of disease may be conveyed from person to person by direct contact; this, no doubt is the chief method, the greatest number of infections being probably brought about by the introduction of germs into the mouth and respiratory passages by the fingers, or by food and drink.

The public drinking cup, the dirty lavatory, careless spitting and coughing in public places and the almost universal practice of touching the lips with the fingers contribute largely to transmission of disease. The necessary toilet procedures, the handkerchief, dirty hands—are all sources of danger not only to the individual but to other people as well. Only absolute cleanliness can protect from contact-infection. Formerly it was thought that articles used by a diseased individual might retain their infectious nature for some time following use. This is now considered to be rather an uncommon means of infection, direct or indirect contact soon after the organism has been released being the much more usual.

Articles of food and drink readily act as vehicles of infection; milk, because it acts as an admirable medium for the growth of most organisms and also because of the possibility of its being infected during handling, is especially liable to carry disease-producing organisms. Water is readily polluted by excreta and thus scatters infection; but the air is probably unimportant in this regard, for expired air does not in itself

contain germs; it is only when it is laden with droplets of excretions derived from the respiratory membranes, or when the air is filled with dust, that air-transmission of disease may occur.

Malaria, Yellow fever and several other diseases are transmitted by the bites of bloodsucking mosquitoes and other insects. Flies may carry infective material on their legs, this material they may carry to articles of food upon which they alight. Animals suffering from Hydrophobia may transmit the disease by biting human beings-

In the management and the prevention of the spread of disease there are several procedures which apply more or less generally. **First**, all cases of infectious nature should be reported at once to the Health Authorities. This is required by Law in most communities. The necessity for this depends on the fact that most persons are apt to be careless about the health of other persons and will not, unless required by Law, adopt proper precautions to avoid the spread of any infectious disease with which they may be afflicted. When the case is reported, the Health Authorities should see to it that the patient is cared for in such a manner as not to endanger others. This is accomplished by the use of such measures as Isolation, Quarantine, Disinfection, Vaccination and Destruction of vermin, mosquitoes, rats etc.

The value of isolating a patient with an infectious disease rests on the fact that the disinfection of the discharges cannot otherwise be guaranteed, nor persons who might visit the sickroom be prevented from coming in contact with infectious agencies.

Quarantine is only a more complete isolation of the patient. Isolation refers to the nurse and patient, Quarantine refers to the premises and all persons within the premises.

Disinfection is the art of destroying the disease-producing organisms, which exist in the infectious material.

In diseases such as Diphtheria, Pneumonia, Influenza, Colds, Scarlet fever, Tuberculosis etc., which are spread by the discharges from the nose and the throat or by the excreta, the greatest care should be taken to **burn** all the discharges and all objects which may contain them, or to chemically destroy the infectious organisms.

In former times it was always customary to disinfect all the rooms and premises where infectious cases had been **housed.** At present it is thought to be more efficient to destroy or disinfect everything used by the patient immediately after use and to take extra care in the method of disposal of all excreta; the nurse is also warned to be scrupulously clean and to be especially careful to wash her hands after touching the patient or any object which may be contaminated.

Inoculation is another means of preventing disease. The principles underlying the process have been discussed already under Immunity. Typhoid fever and smallpox, cholera and plague are examples of diseases in which inoculation as a prophylactic measure is of the greatest value.

The fact that certain varieties of mosquitoes carry the organisms of Malaria, Filariasis, Yellow fever, Dengue etc., makes it incumbent upon a community to destroy these insects. The flea which infests rats, may bite a person and infect him with the organisms of plague. Rats are, therefore, dangerous and should be destroyed.

In the following pages will be given a description of the commonest Infectious Diseases with a brief note as to their causative organisms and the prophylactic measures which are used for their prevention. The diseases will be grouped according to practical sanitary considerations.

Meanwhile, it is found essential to describe here the method of disinfection in detail and the role played by insects in the transmission of disease especially in the Tropics.

1. Disinfection

The main object of disinfection is to destroy the pathogenic microbes, the causative agents of disease, and their more resistant spores so as to prevent the spread of the disease to other individuals We have seen that these microbes are given off from the bodies of patients in their urine, foeces, nasal and bronchial discharges, vomit etc. and are present on the floors and walls of rooms, on clothing, furniture, in and around latrines, cess pools and rubbish heaps. We have, therefore, to find

means of destroying them without at the same time causing any damage to property or material.

Now, substances which completely destroy micro-organisms are known as Disinfectants. Antiseptics are substances which inhibit or put a stop to the further growth of bacteria and thus prevent decomposition; they do not necessarily destroy micro-organisms. Preservatives are closely allied to antiseptics and preservation of foodstuffs etc., are really antiseptic processes. Deodorants do simply absorb or oxidise the gaseous products of decomposition and thereby destroy foul odours; deodorants have however, no special action on bacteria themselves. Odours are the tell-tales of filth, and simply masking them is a most fallacious remedy especially in the Tropics.

A careful distinction should, therefore, be made between disinfectants, antiseptics and deodorants as there are many preparations in the market which are sold as disinfectants, but which are really deodorants with at the best some feeble antiseptic properties.

When disinfection is so complete that all forms of bacterial life are destroyed the term "sterilisation" is used.

Disinfectants may be classified under:

(1) Natural disinfectants—Sunlight, fresh air, drying or desiccation have, we have seen, a destructive effect on the micro-organisms, especially the direct rays of the sun. It has been shown that typhoid bacilli are killed in from one and a half to 2 hours by the direct solar rays, and in 5 hours by diffused daylight, and the diphtheria bacillus is destroyed within one hour by direct sun's rays; while Koch found that the tubercle bacillus is killed by the rays of the sun in from four minutes to several hours according to the thickness of the mass exposed. Few bacteria can therefore survive exposure to sun's rays for more than a few hours. Even Anthrax spores, the most resistant of all, are killed by exposure to the sun for 30 hours, while the anthrax bacillus cannot live more than one or two hours in the sun. The ultra violet rays of the sun have been utilised in the destruction of mosquitoes and low forms of organic life, and also of bacteria in water. Electricity passed into milk effectively sterilises it and

prevents it from getting sour for some days. Water can be sterilised and rendered free from germs by the passage of electric sparks through it. The preservation of sun-dried grains is due to the disinfecting effect of the solar rays.

(2) **Physical Disinfectants** include Heat (dry and moist). Heat is the most commonly used disinfectant. There is no constant temperature at which bacteria are killed by heat. Thus bacteria exposed to heat might all be destroyed in 2 hours at 47°C, but in 18 min. at 51°C and in 2½ min. at 55°C. All disease microbes can be killed and also their spores by an exposure of one hour to a temperature of 100°C, that is, the temperature of boiling water.

The simplest and most effective method of disinfection by **dry heat** is by burning fire. Articles like bed clothes, pillows, mattresses, rags, old clothes and sweepings, soiled with the discharges of cholera, typhoid, dysentery patients are best disinfected by burning. Excrementa are best destroyed by mixing with sawdust soaked in kerosine oil and setting fire to. During plague-epidemics country houses and huts infected with plague rats which cannot be efficiently disinfected are effectively dealt by burning down.

Moist Heat. Boiling for half an hour is for all practical purposes sufficient to disinfect any article such as feeding utensils, forks, spoons etc. but care must be taken to see that the articles are actually penetrated by the boiling water. A bundle of clothes thrown into a vessel of boiling water at once lowers the temperature and boiling ceases for some time, while the water reaches the centre of a tightly-tied up article only with difficulty.

Typhoid bacilli are killed in 10 seconds and many pathogenic spores are killed in as little a time as 5 min. of boiling. Woollen materials like blankets are likely to be spoiled by prolonged boiling owing to the great shrinkage they undergo.

The most efficient method of using moist heat is in the form of steam. Exposure to steam at 100°C for one hour is sufficient to destroy all pathogenic bacteria and their spores. Articles may be disinfected or sterilised by exposure to the action of steam at 100°C at the pressure of ai r for 3 hours, but a current is nece-

cessary in order to expel all air from the interstices. Steam has great penetrating power. This power is due to the condensation of the steam as it advances into a colder object and the resulting formation of a partial vaccuum, which is at once filled by more steam and the process continues until the entire mass of article to be disinfected is raised to the same temperature as the steam.

If the steam is kept under pressure, as in special forms of steam-sterilisers, its temperature can thus be raised to even 115° or 120° C, and this temperature is sufficient to completely sterilise the articles within 15 to 30 minutes. This is the method adopted in hospitals in sterilising linen, cotton wool, dressing etc.

Cotton and silk will bear moist heat till about 120°C for half an hour; but white woollen materials at this temperature become brownish and shrink greatly. Infact all woollen things lose their elasticity and softness from high temperature even of moist heat as they then lose the small amount of wool-fat contained in them. Clothes soaked in blood, foecal matter and other discharges should first be soaked in cold water before being disinfected by boiling or even by chemical disinfectants as otherwise the albuminous matter clots and sticks to the linen leaving a stain, which is impossible to be removed.

Leather goods and Books are best disinfected by means of hot air or direct exposure to the sun's rays.

(3) **Chemical disinfectants.** The chief gaseous disinfectants are sulphur dioxide (produced by burning sulphur in air), Formaldehyde and chlorine. These may be used to disinfect the room occupied by patients with measles, small pox and similar infections. Chlorine is a bleaching agent also and all the three disinfectants are powerful deodorisers too. Sulphur fumigation was held in high esteem in the 16th and 17th Centuries A. D. and has been regarded as a preventive against plague even from the days of Hippocrates.

Liquid disinfectants are: (1) solution of mercury perchloride (corrosive sublimate); to be effective it must be used in strength not less than 1 in 1000. (2) Carbolic acid solution in water 1 in 8. (3) Izal, 1 in 500 kills Bacillus of Typhoid in 15 minutes, but is generally used in strength of 1 in 100 for disinfect-

ing rooms and furniture. Izal is a good deodorant. (4) Cyllin is also a deodorant and is used in strength of 1 in 300. (5) Lysol kills most bacteria in one hour in 1 in 60 solution. It is soapy and therefore cleansing. For plague-disinfection kerosine-oil emulsion is particularly useful, It is prepared thus: 3 parts of sunlight soap are dissolved in 15 parts of water by boiling, and warm kerosine oil is gradually added up to 100 parts, thorough mixing being obtained by constant shaking and stirring. A dilution of this emulsion may be used for washing the floor and spraying the walls of a badly infected house, and rat fleas are killed in 2 min. by a 1 in 100 or 1000 dilution.

Solid disinfectants act only in solution or in the gaseous state as they then have a great penetrating power. Burnt lime—best used as a white-wash to the walls. It has the power of absorbing foul gases and may be used to deodorise cesspits and open drains. A coating of burnt lime painted on a moss-covered slippery surface and allowed to remain in the dried state for a few hours removes all moss and algae.

Bleaching powder. Perchloron—a substitute for bleaching powder--is a powerful disinfectant and deodorant and is a bleaching agent also. 1 in 100 to 1 in 1000 is a convenient strength. (See under water disinfection). Potassium permanganate is largely used for disinfection of wells.

Soap. Common soap must be regarded as the most generally used of the chemical disinfectants and a most powerful agent against the germs of disease. The alkali in household soaps not only destroys germs but tends to dissolve the outer covering of their spores also. It also washes away the greasy material which frequenty protects germs from the action of sunlight and is therefore a very valuable disinfectant.

Most of the so called disinfectants, it must again be impressed on the reader, are really deodorisers with very little germicidal properties, and it is unsafe to depend upon any disinfectant without being certain of its real germicidal value. And it is waste of time to try to disinfect a room or house with a substance which cannot kill bacteria or which has a low germicidal power.

Practical Disinfection

Now, Disinfection of houses is always necessary in the case of plague, cholera, smallpox and occasionally of measles. In disinfecting an inhabited room or house it is always of advantage to collect and burn all foul and useless rags and rubbish. For houses of the poorer classes plenty of fresh air and sunlight are also of the greatest importance, and the removal of tiles and thatch not only admits these natural disinfectants but also assists in the rapid drying of wet-floors and walls. In better class houses disinfection may be carried out by washing or spraying walls and floors with 1 in 1000 solution of Mercury perchloride, cyllin, izal or carbolic solutions of proper strength.

If the room is actually occupied by a sick person suffering from an infectious disease attention should mainly be turned towards preventing the spread of infection. If the disease is one that is carried through air isolation of the patient is of the first importance, but emanations from his skin may be disinfected and be prevented from passing into the air by smearing the skin with carbolised oil or paraffin. The floors and walls of the room should be washed with a strong disinfectant, care being taken that no crevices or corners and articles of furniture are neglected.

After the room has been vacated disinfection of all parts should be most thorough. Feeding andcooking utensils can be boiled for 15 minutes. Table-knives and forks can be soaked in strong carbolic solution for 2 hours. Disinfection of clothing is very important as most infections do cling to clothing especially woollen articles for a long time, and in this way were very often carried and spread. Hence all clothing and bedding used by the patients suffering from smallpox, measles,scarlet fever etc. should be boiled in water for half an hour or soaked in a strong disinfectant for 24 hours before being sent to the dhobi. Articles which will be damaged by boiling or wetting may be disinfected by dry heat if a suitable disinfecting chamber is available. Thick bulky articles such as mattresses and blankets are best disinfected in a steam disinfector. If this is not practicable they may be soaked in mercury perchloride solution and then spread out in

the sun to dry. Of course clothings etc. and things of little value grossly contaminated can be destroyed by fire.

Soiled rags and sputum, urine, foeces and other discharges should be received in vessels and well mixed with some very strong disinfectant such as cresol solution or phenyle solution 1 in 200. After half an hour's time the mixture may be burnt or buried. The disinfection of excreta and of clothes and bedding soiled with them is particularly important in Cholera, Typhoid fever, Dysentery etc., but it should on no account be neglected in other infectious diseases like Smallpox, Tuberculosis etc.

Well-made and well-kept latrines should not usually require disinfection. During epidemics, however, when they may possibly have been used by people suffering from readily communicable diseases, disinfectants are essential. Sulphuric acid solution (3 ounces thrown into 4 gallons of water) is probably the best disinfectant for latrines and even cess-pools and open drains.

It is probable that a considerable number of infectious diseases may be spread by means of food and drink. Thorough cooking is a certain disinfectant and during epidemics especially it is a wise precaution to cook or boil all articles of food and drink which are not entirely above suspicion. After cooking they should not be kept in any place where they may be exposed to infection by man, domestic animals or by insects and dust.

A great deal of sickness and disease among children and students, such as measles, smallpox, diphtheria, influenza etc. can be prevented by the systematic disinfection of school-rooms and hostel dormitories. After the work is over all furniture, walls and floors should be thoroughly washed with a good disinfectant such as cyllin 1 in 300 or 400. Windows and doors should be left wide open as it is too often the practice to shut these and lock up the rooms immediately the classes are dismissed.

In the matter of disinfection if no disinfectant is at hand and in case of doubt as to the best means of disinfecting a given article the simplest rules to follow are:

Boil everything that can be boiled for half an hour; scrub everything that can be scrubbed with hot water and common soap and expose to the sun to dry. Other things may be exposed

to the sun for some hours, not less than 6 hours. Water and milk and food can be rendered safe by boiling and cooking.

IV. Insects in Relation to Disease

The relation that exists between insects and disease is some what varied. In some cases it is a purely accidental and mechanical one; such a condition exists, for example, when a fly picks up typhoid or cholera germs on its feet from a contaminated heap of decomposing matter or from the privy and transfers them on to our food; but where the flea transmits plague from rat to man the role this insect plays is a more active one, since it sucks the plague germ out with the blood of the rat and later injects it into the blood of man. This too is, however, an essentially mechanical phenomenon, and so it can be said that in general the spread of bacterial parasites by insects is accomplished in this mechanical fashion.

In other diseases such as malarial fever we find the picture a different one. The parasite of this disease is a protozoon and has to pass through certain stages of complex development in the body of the intermediate host, the mosquito, before it is injected by the mosquito into another host, man or animal. For this "biological transmission" as it is called a definite period, corresponding to the time taken by the parasite to complete its life-cycle in the intermediate host must elapse before this intermediate host can infect man or susceptible animals. Ever since 1877 when Manson first demonstrated the development of Filaria in the Culex Mosquito, and Ross in 1897 showed the development of the malarial parasite within the body of the Anopheles variety before being transmitted to man, and later in 1907 Bruce recognised that the biting fly (glossina) acted as the transmitting agent in the African Trypanosomiasis (sleeping sickness of Gambia, or African lethargy) considerable attention has been paid to the study especially of the biting insects, and several diseases are now known to be definitely attributable to the activities of such insects. A knowledge of the life-history of these is, therefore, essential in regard to the hygiene of the

individuals and of the community especially those resident in the Tropics, where such a knowledge enables one to adopt the proper measures of preventing disease by controlling the incriminating insect.

Insects may also cause disease in man directly by living and feeding on man as parasites. We have seen already how the pediculus (body louse) and the acarus (itchmite) cause particular skin lesions in man. There is one condition, called myiasis, which is caused by fly-maggots living parasitically in the nasal cavity of man in the tropics.

True Insects belong to the class, Insecta, and have their body divided into head, thorax and abdomen and have six legs (hence they are named Hexapoda). The head has the mouth-parts, the eyes and a pair of antennae (feelers). The eyes of insects are "compound" eyes being composed of numerous minute simple eyes closely packed together to enable the insect to have large field of vision all round without having to turn the head. The thorax is usually composed of three segments, which in many cases are fused together and the component segments are indistinguishable. Three pairs of jointed legs are attached to the thorax on its ventral side (under surface), one pair to each segment of the thorax; in addition to the legs the thorax carries dorsally (back part) two pairs of wings, a pair on each of the 2nd and 3rd segments of the thorax Hence the insects are named Diptera. These two pairs of wings may, however, be modified or be rudimentary or even absent. Thus, in beetles the front wings are hardened and act as shields for the protection of the hind pair of wings, which are the actual functioning wings. In the fly and the mosquito only one pair of wings is present, the hind pair being rudimentary, and in the louse and flea the wings are absent altogether.

The abdomen of insects consists of several segments and is devoid of any appendages except the genital organs.

The development of insects is some-what complicated. Insects lay eggs, the egg after a certain period hatches out into a larva (or grub or caterpillar stage). The larva grows rapidly in size, moults several times and finally becomes a pupa

(chrysalis stage). This stage is the resting stage during which parts of the mature insect are gradually evolved; after a certain period the **mature** insect emerges out of the pupa.

There is no sex differentiation in the immature forms of the insect as the sexual organs are not fully formed. It is only in the mature stage that the insect is differentiated into the male and the female.

Ordinarily the larva and the pupa are never like the mature parent insect as in the case of mosquitoes, flies and beetles; on the other hand in some forms of insects, such as the bug, the louse and the cockroach, the immature forms closely resemble the mature ones, though much smaller.

The common insects concerned with the transmission of disease to man are:

(1) Mosquitoes and flies (N. O. Diptera).

(2) Bedbugs (Rhyncota)

(3) Lice (anaplura).

and (4) Fleas (Siphonaptera).

The mosquito and the common housefly have mouth-parts capaple of taking up only liquid food. The mosquito, however, is able to pierce the skin and suck blood, but the housefly can only suck exposed fluids.

A. The Mosquito.

Mosquitoes are readily distinguished by the two thin membranous wings densely covered over with scales on the surface and at the margins, and a long proboscis for piercing and sucking. The body is divided into 3 regions, the head, the thorax and the abdomen; the head has a proboscis, a pair of palpi and a pair of antennae (feelers). The eyes are compound, the thorax has three pairs of legs on the underside and a pair of wings dorsally. There are two minute halters which represent the rudimentary hindpair of wings.

The male mosquito is recognised by the densely feathered bushy antennae, which in the female are nearly bald or thinly feathered.

Life history of the mosquito. The female lays eggs on

water, which hatch in two days' time and minute wriggling larvae emerge out of them, the larvae feed on debris and floating matter in the water and grow rapidly moulting several times; after about the 10th day the full-grown larva becomes transformed into a pupa; two days later the adult mosquito emerges out of the pupa by bursting its back skin.

The egg, the larval and the pupal stages do all occur in water. The presence of water is, therefore, essential for the development of the mosquito.

Three kinds of mosquitoes are commonly known and they are:—

(1) Anopheles (Fig. 11, (a), (b), (c), (d).

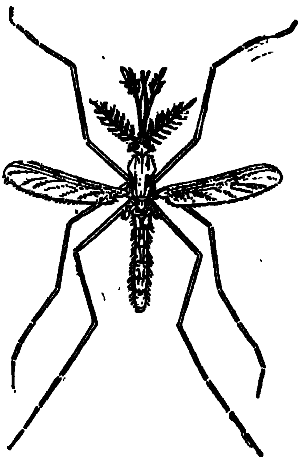
(2) Culex (Fig. 13, (a)

(3) Stegomyia.

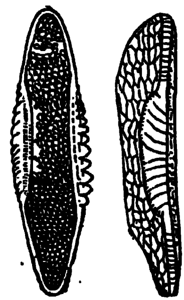
The Eggs. The eggs are cylindrical and laid singly or in masses of several eggs cemented together by a gelatinous fluid. The eggs of anopheles are laid singly and are provided with lateral air floats, which enable the eggs to float on water; the culex however, lays its eggs in raft-shaped masses and the entire raft floats on the water. These egg rafts are characteristic of the culex only. Stegomyia eggs are laid singly and do also float on water though they have no air floats.

The Larva. The body of the larva is differentiated into a head, thorax and abdomen; it is devoid of legs or wings; it wriggles about actively in the water and frequently rises to the surface to take oxygen from the air through the breathing tube or siphon; when the tip of the siphon is thrustout of the water air enters the trachea. If by some means or other as by spreading kerosine oil on the surface of the water the larvae are prevented from breathing, they will die of drowning.

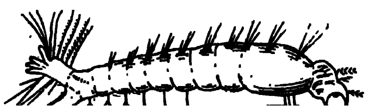
The anophelene larva floats **parallel** to the water-surface when it rests, and it has no breathing siphon. The culex larva has a long and thin siphon and it **hangs down at an angle** from the surface of the water. The stegomyia larva closely resembles the culex larva and can be distinguished from the latter by its short and thick siphon; it hangs almost **perpendicularly** from the water surface. while the culex larva hangs at **an angle**.



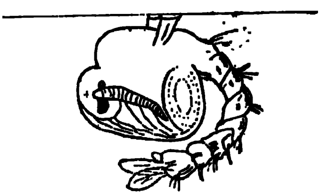
(Fig. 11)
Anopheles—male (adult)



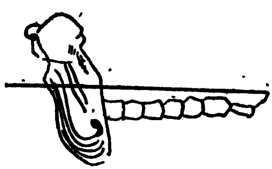
(Fig. 11(a)
Egg—Anopheles



(Fig. 11(b)
Anopheles Larva



(Fig. 11(c)
Pupa—Anopheles



(Fig. 11(d)
Adult Anopheles emerging

The pupa is, as we have seen, a resting stage in the development of the adult mosquito, at which the various parts of the adult insect get fully formed. The pupa is also active and moves by jerks; it does not feed, but requires oxygen for breathing, which is accomplished by means of the two trumpet-shaped breathing siphons placed on either side of the body.

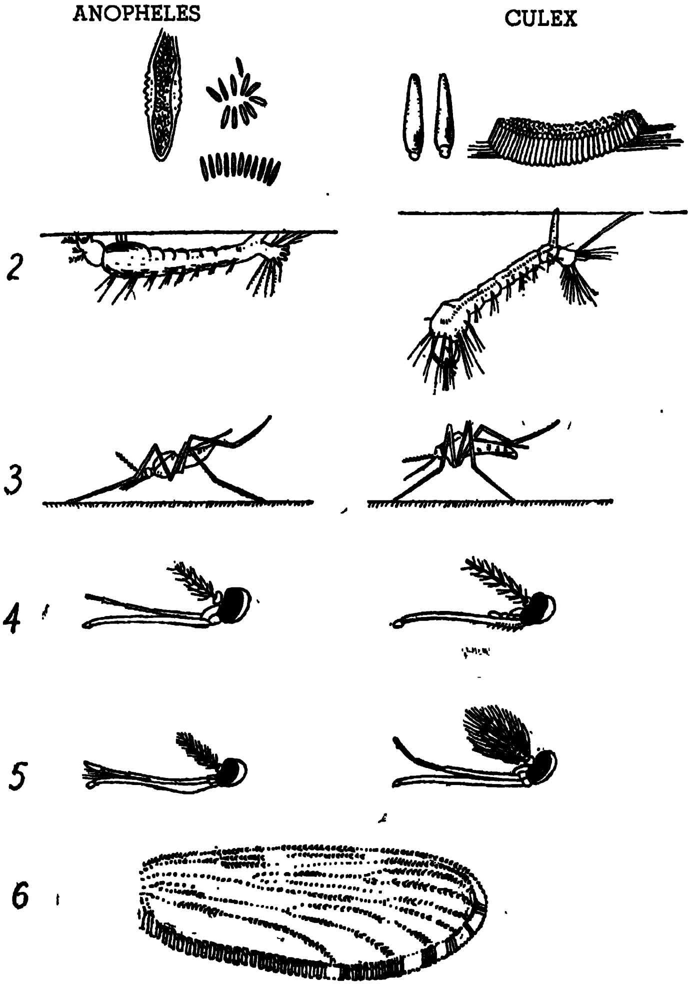
The adult mosquito is easily recognised by the manner in which it rests. The culex and the stegomyia rest in a "hunch backed" manner with the proboscis forming an angle with the line of the abdomen, but the anopheles rests differently, the line of the proboscis being continuous with the line of the abdomen. Another characteristic of the anopheles is the presence of clearly marked black and white spots on the wings; such spots being usually absent in either the culex or the stegomyia.

The following is a summary of the differentiating characters of the Anopheles and the Culex. (Fig. 12)

	Anopheles	Culex
1. **Eggs.**	Laid **singly** and have **floats**	Laid in **raft-shaped** masses, no floats.
2. **Larva,**	Floats **parallel** to the surface of the water; has no breathing siphon.	Hangs down from surface of water while resting; breathing siphon present.
3. **Adult.**		
(a) Attitude.	Sits straight with the proboscis in a line with the body.	Sits hunch-backed with the proboscis forming an angle with the body.
(b) Wings—	Spotted	Of uniform colour.

The stegomyia is grouped under culex in the above Table. It is essentially a domestic mosquito and is easily distinguished by the brilliant black and white bands on its body and legs. It attacks man during daytime and breeds in collections of water in houses and nearby.

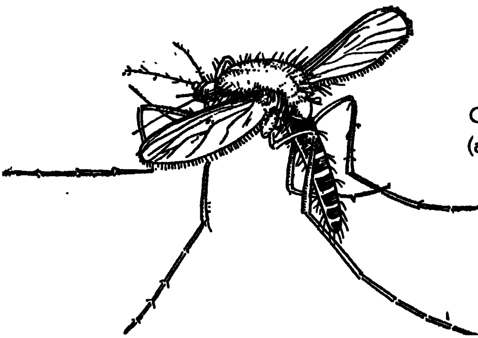
Mosquitoes are known to carry several diseases in man. E. g. the Anopheles are the transmitters of Malaria; the Culex acts as the intermediate host of the worm, Filaria, (the cause of Elephantiasis in man) and transmits its embryos (micro-



1. Eggs. 2. Larva. 3. Attitude or Resting posture.
4. Head of Female. 5. Head of the male.
6. Wing of the anopheles.
(Fig. 12)

filariae) contained in the blood of the infected person to another. The Stegomyia is responsible for the spread of Yellow fever and Dengue.

The variety of stegomyia known to transmit yellow fever goes by the name of Aedes Aegypti. It is a house mosquito, as we saw breeding not in swamps but in small receptacles of water adjacent to dwellings. This kind of mosquito is very common along the Mediterranian and the Black Sea, and the



(Fig. 13)
Culex fatigans
(adult—female)

increased facilities for travel by aeroplanes and automobiles threaten the entire world with the danger of spreading Yellow fever from these parts.

It is important to remember that it is only the female mosquito that is the blood-sucker and not the male; and one important fact regarding these blood-suckers is that they always prefer the blood of rabbits to human blood; and advantage has been taken of this fact to rear rabbits in human dwellings to minimise the attacks of the mosquito on man.

To prevent mosquito-bite the following is recommended:

Anti-mosquito paste.

Camphor	1 ounce
Menthol	1 ounce
Oil of citronella	5 min.
Oil of Turpentine	10 min.
Castile soap	3 ounces
Kerosine oil	1 dram

Rub the menthol and Camphor in a mortar and add the citronella and Turpentine oils; next add the soap and Kerosine oil and mix well. *(G. O. H. Madras).*

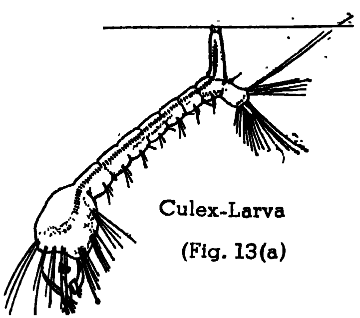
Composition of "FLIT"

Kerosine oil	1 gallon
Phenol	200 c. c.
Creosote	50 c. c.

Mix well.

B. The Sand fly. *(Phlebotomus papatissii).*

A minute insect belonging to the genus Phlebotomus, generally seen in dark corners and damp places. When disturbed it flies away with a hopping movement. It is recognised by its small size, fragile appearance and thin lanky legs. When resting its wings are held erect. (Fig. 14).



Culex-Larva

(Fig. 13(a)

The fly has a dense covering of fine hair over the entire body and the wings, and this is a characteristic of this group. It has its mouth-parts adapted for piercing and sucking, and like the mosquito only the female is the bloodsucker.

Sandflies frequently attack man, and in some places form a terrible pest. Their bites are painful. Being so minute they are able to enter the ordinary type of mosquito curtain with ease. The insects are nocturnal in habit and may occasionally be seen attracted near lights at night. Sandflies breed in damp mud mixed up with organic matter. The eggs are minute and laid in damp mud in dark places and hatch in 4 to 6 days. The larva is caterpillar-like and is devoid of legs. It feeds on organic matter in the mud and is transformed into a pupa, which matures in a few days.

The common diseases in man known to be transmitted by the sandfly are:

(1) Sandfly fever (Papatassii fever)

(2) Oriental sore (Dehli-Boil)

(3) Kala-azar. The parasite of kala-azar has been recently demonstrated in the foregut of a species of Phlebotomus common in most parts of India, and it has been suspected that the sandfly transmits the parasite to healthy people through its bite, but the final opinion that the actual transmission is due to the bite of this fly is yet to be established.

The sandfly is a vicious blood-sucker and its bite is, we said, very painful. As these flies are the transmitters of the various diseases mentioned above care should be taken to avoid them.

(Fig. 14)

Sandfly (male) Sandfly (female)

In areas infested with sandflies it would be necessary to use a mosquito net with a much finer mesh than the ordinary type.

Certain drugs and applications to the body have been known to repel the sandfly. Such a mixture as the following suggested by Crawford is a useful one. It consists of:

Ol. Anisi...one dram

Ol. Eucalypti.. one dram

Ol. Terebinthinae . half dram

Boric ointment...one ounce.

Mix well.

This ointment smeared lightly over the exposed parts of the body acts as a good repellent and antiseptic.

C. The Common House-fly (*Fig. 15*)

House flies belong to the family Muscidae, of which there are several varieties: the grey or housefly (known as Musca domestica), the biting stable-fly, the green bottle fly (Chrysomyia) and the blue bottle fly (Calliphora). They are all Diptera (having two pairs of wings). Their mouth-parts are adapted for sucking **fluid** food but they cannot bite. The sucking proboscis is usually folded up under the head and it is recognisable only when the fly ex-serts the proboscis in attempting to feed. The tip of the proboscis has a pair of large flaps, which enable the fly to have a larger feeding surface and easy suction of food. The head has a pair of large and very conspicuous compound eyes. The thorax has a pair of large membranous transparent wings starting at the middle and a pair of minute knoblike

Fig. 15 ×20
The Common Housefly

Fig. 15(a)
The Housefly in the act of regurgitating liquid food
(*After Hewitt*)

structures known as "halters" or balancers, which represent the vestigial hind pair and are usually under cover of the base of the wings. The abdomen consists of several segments usually four in number.

Common flies breed in decaying animal and vegetable matter. The eggs are laid on the moist decomposing organic matter, such as cowdung heaps, horse manure, pig manure, human excrement, decaying grain and hay, excreta soiled straw, paper and rags, decaying kitchen-refuse, rotting fruits and vegetables; they are small elongated and cylindrical, white or

yellowish-white in colour and usually found in masses, the individual eggs sticking together by the gummy secretion on them when freshly laid.

A single female housefly lays from 100 to 150 eggs in a single batch, and such egg-laying may happen about 4 times during the entire life-time of the fly. When the eggs hatch the fly-larvae emerge from them. These are the maggots commonly seen in decomposing matter or dung. The larva is long and tubular, white or yellow in colour with a tapering front end and a thick and truncate hind-end. The pointed end is the mouth-end, the larva being devoid of a head.

On the hind-end are two dark plates which form the openings of the breathing system of the maggot. The maggot feeds actively on organic matter, moults several times, becomes transformed into the pupa (chrysalis), which is the inactive resting stage. After a certain number of days the mature fly emerges out of the pupa by a circular opening at one end of the pupal case.

Flies cause diseases chiefly by mechanically transferring disease-germs on to our food. As flies feed with equal relish on both filth and human food they commonly transfer various disease-producing germs from filth, sputum, pus etc. to food, milk or sugar. Numberless bacteria can stick to the legs, body or the proboscis of the fly; and when the fly walks on food or utensils the bacteria are deposited on them. Millions of bacteria may thus be carried by flies on to man's food. Studies made in New York some years ago showed an average of 14,000 bacteria on the outer surface of bodies of flies from "**clean**" localities as compared with an average of one million on flies collected from "**dirty**" surroundings. Both Cholera and Typhoid germs have been isolated from the bodies of flies.

Another factor that increases the chances of infection is the habit of the fly to deposit its foeces while feeding. Often swarms of pathogenic bacteria pass out unaltered in the foeces of the fly, and if the fly had previously fed on infective material, our food might get contaminated with bacteria contained in the foecal deposit of the fly.

Another dangerous habit of the fly is the regurgitation of food. When it feeds on any food (only liquid food) the fly draws it first into a large chamber known as the "crop." This crop acts as a reservoir into which the food is stored especially when the fly feeds in a hurry, and later at leisure it may bring back the contents of the crop into the mouth and vomit it out. During this regurgitation process the contents of the crop may be deposited on human food, and if the fly had just prior to this act fed on material contaminated with the germs of disease such disease could be produced in the consumer.

The fly also frequently utilises its crop-contents as a solvent to solid foods such as sugar or candy. When this happens some portion of the crop-contents is invariably left on that material and this may account for much disease-infection.

The part played by the housefly, better called "the filth-fly," in the transmission of typhoid fever, has been often exaggerated in the past, but it is nevertheless a real one. It was the experience of the American Troops in the Spanish War, which first forcibly called attention to the danger of transmission of disease by flies. About one in every five of the soldiers contracted typhoid during the active campaign. Reed and Vaughan, who studied this disastrous affair came by investigation to the conclusion that "the number of cases of Typhoid fever in the different camps varied with the methods of disposing of the excretions." They pointed out in their report that "flies swarm over infected foecal matter in the pits and then deposit it and feed upon the food prepared for the soldiers at the mess-tents. In some instances, where lime had recently been sprinkled over the contents of the pits flies with their feet whitened by lime were seen walking over the foods. Officers whose mess tents were protected by means of screens suffered proportionately less from Typhoid fever, than did those whose tents were not so protected. Typhoid fever gradually disappeared with the approach of cold weather and the consequent disabling of the flies."

Diseases transmitted by flies:

Intestinal diseases like Cholera, Typhoid, Paratyphoid, Summer Diarrhoea, Dysentery (Bacillary and Amoebic) are fly-

borne diseases; and in the Tropics, Ophthalmia (Sore Eyes) and various skin affections are dis-seminated in this way,

Certain flies deposit their eggs on a foul-smelling open sore and cause great trouble. This condition is known as myiasis. It is said that Yaws in the Tropics spreads in this manner.

Now in order that a particular species of flies may play an important role in the transmission of intestinal diseases they must habitually resort to human excrement and food in the kitchen and dining room. The common housefly is abundant both in the dining rooms and in privy vaults and is therefore the one species of real danger. It should not really therefore, be a "**housefly**" if we took proper precautions. It will always be a "filth-fly" and that would be a much better name for it.

The most effective of all means of controlling flies are: (1) to prevent the exposure of any decaying vegetable and animal matter, such as cowdung, horse litter, street and domestic refuse, night soil and carcases in which flies breed; such refuse should be buried or incinerated to prevent flybreeding. Manure and refuse if kept loosely stacked is a very favourable breeding ground for flies. If on the other hand they are thrown out into a pit and thickly packed and then tightly covered over with mud the heat produced by the decomposition is sufficient to kill maggots of flies that may be breeding in them.

A highly ingenious method of handling manure, which is particularly useful on a farm is based on the fact that the fly larva cannot pupate in moist manure but must find its way downward into the drier soil below. The manure is stored on a slatted platform standing over a shallow concrete basin containing 2 or 3 inches of water. Each day the stable cleanings are placed on the platform completely heaped and well moistened. Flies lay their eggs in the manure, the larvae develop and when ready to pupate they migrate to the drier ground around and drop down into the water and are drowned. In the Kudlu cocoanut farm we saw one April morning as many as 300 larvae of flies killed in this manner.

Proper control of stable manure will go far to lessen the number of flies in a locality, but if stable manure is absent flies

will naturally lay their eggs in other decomposing material and careful attention to all such organic deposits is therefore essential.

(2) Control of fly-breeding must be supplemented by efforts to destroy the adult flies. Sticky flypapers, particularly the long slender roll hung from the ceiling are helpful. So also fly swatters.

The best device for dealing with adult flies, however, is a trap (Fig. 16) of the following description. This device depends upon the tendency of the fly to go towards light. It consists of a wire-gauze cone with a large opening at the bottom and a small opening at the top, which opens into a wire-gauze cage.

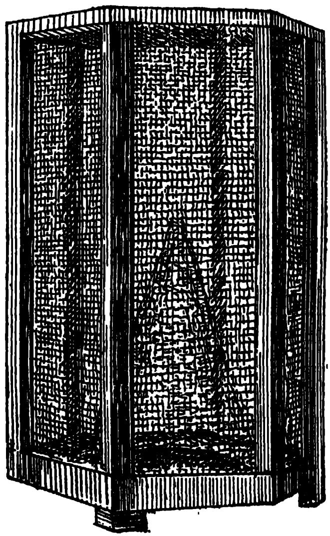


Fig. 16—Fly-Trap.

Suitable baits such as highly flavoured fruits like the jack fruit, firmenting banana or pine apple, molasses etc. are placed in a saucer below the large lower opening of the cone. Flies attracted by the odour of the bait feed upon it and then crawl and fly upward to the small upper opening of the cone, through which they pass out into the cage from where they cannot escape.

In the case of the jack fruit bait the sticky material of the fruit fixes them on the bait itself. The whole cage can then be immersed in water, which drowns the flies.

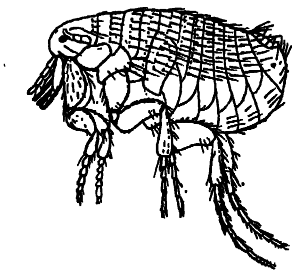
(3) Finally, it will of course help materially to control fly-borne diseases if human excreta and food are properly protected from access of flies by tightly constructed privies on the one hand and by screening kitchens and dining rooms, restaurants,

food-stores etc. with fly proof gauze on the other. Failing this all food should be protected by covers or doolies.

D. The Flea

Fleas are minute parasites living externally among the hair and fur of mammals. They are wingless insects with a small inconspicuous head and a body which is hard and glistening and compressed flat laterally. Considering their very small size they can jump to considerable lengths and heights although they are wingless. This they are able to do by means of their powerful legs. The legs are provided with strong claws which enable the flea to get a firm hold on to the fur of its host. The lateral flattening of the body facilitates easy and rapid movement in between the hairs of the host.

(Fig. 17)
Xenopsylla Cheopis (Rat-flea)
Adult.



Larva of X. Cheopis (Rat flea)
(Fig. 17(a)

Fleas are blood-suckers, their mouth-parts are adapted for piercing and sucking. Unlike the mosquitoes and other insects in which only the females are blood-suckers, fleas of both sexes live on blood. There are several common kinds of fleas, such as dog-fleas, cat-fleas, rat-fleas (fig. 17), (Xenopsylla Cheopis) and the human fleas. But the most dangerous of all is the rat-flea, which has been known to transmit bubonic plague and is common on rats in many parts of India.

Plague is transmitted by a process very different from that by which other insects transmit insect-borne diseases. Normally the plague bacillus (Pasteurella pestis) causes the disease in rats in an epidemic form at certain times of the year. The infection of rats with plague is a natural one and the spread of it to man

is only a side-issue and largely accidental. In the infected rat suffering from plague, the plague bacilli are present in large numbers in the blood stream. Every drop of blood of the infected rat contains large numbers of bacilli and any flea that feeds on such infected rats gets some of these bacilli into its stomach. In the case of fleas belonging to the species, Xenopsylla cheopis, the stomach and proventricular region seem to be very favourable for the development of the plague bacillus and it multiplies prolifically and with great rapidity. As a result of such multiplication the stomach of the flea is within a very short of time filled with a dense mass of plague bacilli, and this mass blocks up the front part of the gut. Fleas with their guts blocked in this manner by a plug of plague bacilli are incapable of taking any more food with the result that the flea develops a great appetite and thirst. This makes the flea attempt to bite with much avidity. When a flea with a blocked gut tries to feed on a healthy rat or on man a small amount of blood is drawn up into the pharynx as a result of the sucking action of the pharyngeal pump, but this blood is prevented from getting into the stomach owing to the blocking in the region of the proventriculus. When, finally, the flea stops its futile efforts to feed, the blood in its pharynx gets back into the puncture (wound) in the bitten animal as a result of the recoil of the pharyngeal pump. This blood which is sent back into the wound is contaminated as the result of contact with the mass of plague bacilli in the fore part of the gut of the flea.

The inoculation of the blood contaminated with plague bacilli into the wound in the manner described above brings about the disease, plague.

The chance of infection of healthy rats as also of man increases in proportion to the incidence of fleas on rats and also by the tendency of such blocked fleas attempting to feed on as many rats or men as possible and on the length of life of these fleas.

Xenopsylla cheopis is the principal transmitter of plague in India. The life of these fleas being entirely dependent on the existence of rats, and as rats form the sources of infection of fleas

with the plague bacilli it is evident that rat-destruction is the main method of plague-prevention.

E. Ticks (Fig. 18)

Ticks are external parasites commonly seen attached to dogs aud other domestic animals- The body is not easily differentiated into a head, thorax and abdomen as there are no constrictions nor any demarcations between them. Hence the whole body is one mass with a head not clearly recognisable. The mouth-parts serve to pierce the skin of the host for blood-sucking and also to hold on to the host. Ticks have four pairs of jointed legs in the mature stage, and in the immature stage only 3 pairs. They lay innumerable eggs from which tiny ticks hatch out. The young ones are exactly like the parent forms, but have only 3 pairs of legs instead of four pairs.

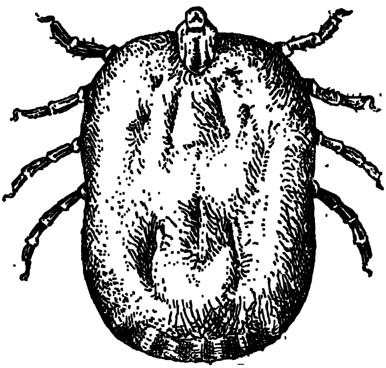


Fig. 18– Tick ×50

There are two kinds of ticks, known as the hard ticks (Ixodinoe) and the soft ticks (Argassinoe). The former are the ones usually seen on dogs and animals, while the latter are less frequently seen. This is due to the habits of the latter ticks, which come out of their resting places only at night and get back again after feeding. The hard ticks, on the other hand are more or less permanently fixed on to the host.

In India ticks are not known to cause much injury to man. But it is known that people frequenting jungle areas are frequently attacked by ticks. In a few cases such visits to jungle infested with ticks are followed by attacks of **Tick-typhus.**

Ticks are also responisble for the transmission of **Relapsing fever** in several parts of the world.

F. Bedbugs (Fig. 19.)

Bugs form a very large Zoological group consisting of several thousands of species; but we are concerned only with the bed bugs that attack man.

Bed bug (cimex rotundatus) has a flattish smooth body which enables the bug to get into crevices in wall and furniture with ease. It has three pairs of legs and has no wings. The mouth parts are adapted for piercing the skin and sucking blood; the latter are in the form of a proboscis, which is bent under the head and kept concealed between the bases of the legs. The proboscis is not ordinarily recognisable except when the bug tries to bite. This blood sucker, although generally nocturnal in habit may try to feed at any time of the day or night. Bugs abound in dirty houses and take shelter in beds and furniture and crevices in walls. Common in railway carriages, tram cars and buses and in places where people resort in large numbers.

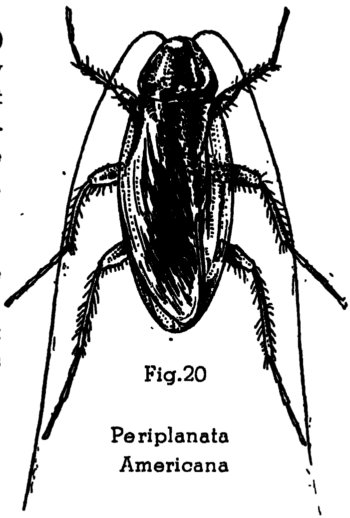
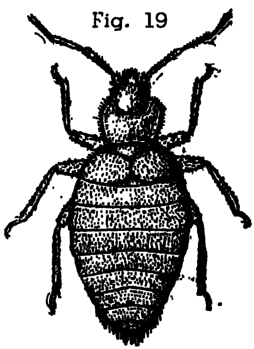


Fig.20

Periplanata Americana

Fig. 19



Cimex Rotundatus
Bed-bug×10

The bed bug inflicts a painful bite, but so far as our present knowledge goes it has not been shown to transmit any human disease, although it has been from time to time suspected to transmit various diseases, and at one time considered to be the vector of Kala-azar and Relapsing fever. It has since

been shown that the bed bug is quite innocuous as regards disease-transmission.

In spite of this fact there can be no justification for tolerating this most disagreeable house-pest. It should be easy to rid a dwelling house of the bed bug as we know of several very effective destroyers of this insect. Petrol and Kerosine are very effective against both the mature and immature forms and also their eggs if properly used. It is best to inject petrol or kerosine into crevices and corners infested with the bed bug by means of an oilcan or spraying it with a small hand-sprayer. Petrol is preferable to kerosine as it is more toxic to the bug, and evaporates more readily without leaving any disagreeable smell. Care however should be taken in the spraying of Petrol not to have an open light nearby.

Fumigation with formaldehyde is often resorted to in Railway carriages. Boiling water or superheated steam is useful when the material is not damaged by heat.

Ammonia and menthol do allay the irritation of bug bite, and also Iodine and Hydrogen-peroxide.

G. Cockroaches (Fig. 20)

These have not been proved to convey any disease except perhaps mechanically being filthy; their presence in a house is a sign of carelessness in sanitary cleanliness. They are often a nuisance in kitchens and places, Cleanliness and use of powdered borax are very effective in driving them away.

V. PREVENTABLE DISEASES

1. Bubonic Plague

This disease by its very name occupies a prominent position in the mind of the general public and therefore requires special description.

The germ of bubonic plague is not present in the discharges of the body and the mediation of a blood sucking insect is essential for its transmission; but when the disease assumes the pneumonic form the germ is of course present in the discharges

of the upper respiratory tract, and then the disease may be transmitted by ordinary direct contact.

This disease, the dreaded "Black Death" of the Middle Ages was early associated with disease among rats. The causative organism, pasteurella pestis, was first discovered by Kitasato and Yersin in 1894, and the identity of the disease in rats and in man was demonstrated shortly thereafter; and in 1906—8 the Indian Plague Commission of Bombay demonstrated that the flea is the normal agent in transmission from rat to rat and from rat to man.

We now know that bubonic plague is primarily a more or less chronic disease of certain wild rodents (rats and marmots squirrels), which serve as permanent reservoirs of infection. From these primary reservoirs (i. e. the wild rodents) the infection spreads to various species of field-mice, from these to the domestic rats and from rats to man. The dissemination of plague on pandemic scale is always associated with the spread of the disease among rats. It is an old observation that a plague epidemic amongst human beings is invariably preceded by a serious mortality amongst rats.

The Public Health Commissioner's Report for 1936 gives 13,000 as the total number of deaths from plague in India, which means .05 per mille (1000) of the population.

The actual transfer of the plague bacillus from rat to rat, and from rat to man is normally accomplished by the bite of fleas, xenopsylla cheopis, (Fig. 14) except of course in the case of pneumonic plague as we saw above. We have seen the fleas, which play a really important role in the transmission of plague are characterised by the fact that their Oesophagus is so constituted that it becomes blocked by the blood taken at the last meal, and that when the flea bites again it removes this obstruction by regurgitation into the blood stream of the victim, thereby providing a perfect mechanism of inoculation.

The geographical and seasonal characteristics of plague are largely determined by the influence of the external temperature on the life-history of the flea. Exhaustive studies have shown that in cold weather the flea-population of the rats

decreases to a low figure and this is the reason why serious epidemics of bubonic plague are not more common and are limited to areas where the mean mid-winter temperature is above 60° F.

Control of plague. The plague germ is a delicate germ and is easily killed by heat and sunshine.

The complete and permanent control of plague could only be accomplished by elimination of the primary sources of infection among the wild rodents. This is, however, acknowledged to be impossible. Nor does the flea, as a link in the chain, furnish any important possibilities of control. The eggs of the flea drop to the ground and the larvae feed on almost any kind of refuse material, even, for example, on floor sweepings. Kerosine or petroleum oil emulsion with soft soap and various coal-tar or creosote preparations or pyrethrum (ಉಕಲ್ ಕಡ್ಡಿ) powder may be used for destroying fleas on domestic animals, and sprinking flake naphthalene over the floors will destroy the larvae in a flea-infested house or stable. Hydrocyanic acid (prussic acid) gas will destroy all stages of the flea's life-cycle. Since, however, it is the rat fleas that play the chief role in transmitting plague, and since the rat nests in which they breed are not accessible direct attempts at flea-control are not of much material avail.

The only really weak link in the chain is the rat and it is in the control of rats that success has been attained in our war against bubonic plague.

Our programme involves two distinct types of precaution:

(1) The breaking of the international chains of infection by Maritime Quarantine.

(2) The control of existing centres of infection and the reduction of the danger of new infection by local rat-control.

Historically plague has always spread along trade-routes, by caravan on land and by ship at Sea, and shipping has constituted a specially important menace, since it involved the transfer of large cargoes of grains and other food materials at whose expense the rats could feed.

Older methods of Quarantine directed against human carriers alone proved almost wholly ineffective since the rats

which passed freely ashore constituted the real danger. Now-a-days such undesired immigrants are kept off shore by ratguards fitted to the hawsers and ships from infected areas are "de-ratised" by fumigation.

Public Health Workers have conducted experiments to find a fumigant which would be (a) effective, (b) as free as possible from danger to human beings, and (c) free from harmful effects on metal-work, paint etc. They have devised a mixture of cyanogen chloride and hydrocyanic acid, known as, "cyano-chlorine," which is on the whole highly satisfactory, the cyano-chlorine through its powerful lacrimatory action (stimulating the flow of tears) serving as a safeguard against exposure of human beings. The rat-holes except one or two are plugged up with mud and the powder is pumped into the holes by a simple air-pump arrangement; the use of this is, however, attended with some danger, and huts to be treated should be vacated for 12 hours at least and not occupied until the whole of the hydro-cyanic acid has evaporated

The local control of rats is accomplished in the presence of a focus of infection by trapping and poisoning (best done with Barium Carbonate mixed into a dough with rice flour). "Common-sense" rat exterminator consists of a paste of phosphorus. White arsenic mixed with boiled rice or beaten rice and Jaggery is a very useful rat-killer, but is a poison to human beings and animals also, and care has to be taken that children and dogs and other animals gain no access to it.

The most important element in the programme, however, is the construction of buildings so that rats cannot gain access to them, and the elimination of adjacent heaps of rubbish and other possible breeding places.

The whole question of prevention of plague is then of domestic hygiene. What is required is to teach the public that they should not allow in their houses collections of rubbish, behind which rats can build their nests; neither should they throw about in the vicinity of their homes remnants of food which will attract rats. In fact every precaution should be taken to prevent the rat from becoming a domestic animal.

Just as in Cholera, so in plague great use is made of anti-plague vaccine to prevent the disease. This vaccine is manufactured at the Haffkine Laboratory at Bombay and is widely used whenever plague is prevalent. Its immunity is for about a year, but its value is greatly recognised by the public during an epidemic and they willingly submit to it in large numbers.

Pandemic plague has broken out on a large scale three times in the history of mankind. The first outbreak was in Egypt in 542 A. D. and spread to every corner of the then known world. The second originated in Mesopotamia about 1050 A. D. and lasted off and on in Europe for 600 years. This was the famous Black Death of the Middle Ages, which killed 25 million people or a quarter of the total population of Europe at its height during the 14th Century. This epidemic in its far-reaching social and economic effects was probably the most significant crisis in the history of the human race. The magnitude of its influence may be understood by the fact that during the Great Plague of London in 1665 in one week of September there were 7165 deaths from plague as compared with 1132 deaths from all other causes put together.

The third great pandemic began in South China in 1871 and reached Hongkong in 1894; thence it began to spread to sea-ports all over the world; and between 1894 and 1904 it killed 6 millions of people in India

It appears that plague was first imported into India from China even about 1629 though there is reason to believe that there was severe epidemic of the disease in Sholapur much earlier, about the end of the 14th Century.

2. Malaria

It is Sir William Osler that once remarked that if a census were taken among the world's workers on disease, the judgment to be based on the damage to health and direct mortality the votes would be given to Malaria as "the greatest single destroyer of the human race." A plausible case has been made out for the theory that the decline of Greece from its position of unique world-pre-eminence to the rank of a fourth-rate power was due to

the introduction of malaria and the consequent selective replacement of a brilliant but malaria--susceptible ruling race by a malaria—resistent slave population. Infact, even the downfall of the Holy Roman Empire has been attributed to the enervating influence of malaria. It is certain that vast areas of the world's surface are held down to the lowest social and economic level by the endemic prevalence of this scourge.

The mortality figures from malaria give a very incomplete picture indeed, as the burden of invalidism and economic inefficiency due to the disease is out of all proportion to its importance as a cause of death; and many of the disabilities of the Tropical climates which were once attributed to climate are really due to malaria.

The annual deaths from malaria in British India is estimated at 1¼ millions, and about 100 million people suffer annually from the disease.

Malaria means "bad-air" disease, and was once supposed to be due to an "earth-born" poison evolved from marshes "when the water level is lowered and the saturated soil is exposed to the drying influence of a high temperature". But the real cause of the disease is now known to be an animal (protozoan) parasite discovered in 1880 by Laveran, a French Army Surgeon.

The parasite attacks the red blood cells, passing through a regular cycle (asexual cycle) in 24, 36 or 48 hours as the case may be. The chill and fever correspond to the phase of this life-cycle, in which one generation of the parasites has destroyed the red blood cells previously invaded and reproduces to spread through the blood stream and attack a new group of red blood cells. Atleast 3 types of malaria are recognised, each caused by a different form of parasite.

The basic discovery which unveiled the secret of malaria was made by Ronald Ross an English Army Surgeon in India, who demonstrated in 1897 the transmission of bird-malaria by the mosquito, and 1898 Grassi and Bignami in Italy furnished the final proof of the mosquito-carriage of human malaria.

We have seen that the malaria-bearing mosquitoes belong to the class of Anophelinae and that they live ordinarily upon·

fruit juices and that the males never bite man. The females, however, require a blood meal in order to complete their reproductive function, and they must, therefore, feed upon one of the higher animals at this period. The germ of malaria is sucked in with the blood when the mosquito bites a human case or carrier, and the parasites pass through a complex process of sexual reproduction in the stomach and tissues of the mosquito, reaching the salivary glands from which they can be injected into a new victim in about 10 or 12 days.

The mysterious connection of malaria and marshes was now atlast explained. Anopheline mosquitoes lay their eggs on protected areas of stagnant water, which in the course of 8 to 20 days depending upon a favourable external temperature develop into adult mosquitoes.

It is an interesting fact of great importance regarding the causation of malaria that certain types of Anopheles prefer cattle to man as a source of blood and therefore play no part in the spread of malaria. Where intensive cultivation is carried on and cattle are kept in stables this change of habit seems often to occur.

Control of Malaria. There are obviously numerous points at which the chain of malarial infection can be broken:

(1) The first of these, in logical order, is the isolation of the sick person and the carrier; isolation of course in the case of malaria involves only the protection of the individual from the access of mosquitoes. Carriers can be detected by blood examination, and what is known as the malarial Index of a community can also be determined by palpating the spleens of children between the ages of 2 and 12. Isolation is of value only where malaria is not common.

(2) Our second weapon in combating malaria is, of course, quinine, which has been known for 275 years as a specific for Malaria. This drug may be used to relieve the symptoms of the disease, to sterilise the carriers and to protect the uninfected. The drug has been no doubt, found highly efficacious in the treatment of the symptoms of disease, but is not satisfactory in sterilising the carrier, for the reason that in some types of

malaria-especially the malignant Tertain type—the sexual forms of the parasite are highly resistent to the action of quinine. Luckily this is the case with only a fraction of such cases; and these few cases yield to Plasmochin.

Finally those who are inevitably exposed to infection in malarious regions may receive a substantial degree of protection by taking 10 grs. of Quinine a day as a routine prophylactic. Valuable results have been obtained in Italy by the use of this procedure.

(3) Another method of protection, which has been used with success in malarial regions is the screening of houses. Since the Anopheles mosquito bites at night and most freely indoors this precaution will materially help to reduce infection. The screening should be of nonrust metal and should have a fine mesh (16 to 18 strands to the inch) so that the movement of air through them may not be interfered with. But they are very expensive and not meant for ordinary people.

(4) The location of the living quarters or "lines" of the labouring population either in Railway Construction works or the Estates have considerably helped in the protection of man against mosquitoes, and is therefore of primary importance. They should be as distant from mosquito-breeding places as possible and not situated on bluffs and moulds overlooking streams or bhils. It has been found by Watson in Malay that if lines are kept free from breeding places for half a mile all round malaria will cease to be an important factor in disturbing work. This principle if applied at the outset in laying out an estate or any other community it would save much disease and distress, interference with work and subsequent expense.

(5) The only really effective and complete methods of malaria control depend on the elimination or even the reduction of mosquito breeding in protected areas of stagnant water near-by, ponds, pools, swamps, ditches and the like. Open ponds exposed to sun's rays and wind will not serve as breeding places; and although the anopheles may fly for a distance of a mile, the origin of malaria is as a rule to be found quite near at hand. The foremost measure of protection, then, is the removal of accumu-

lations of standing water near dwellings by drainage or by filling. The drains, of course, must be open to the sun and free from vegetation, or these will in turn serve as breeding places.

(6) Where swampy areas are extensive, drainage may prove very costly, and it may be necessary to resort to the temporary but reasonably effective means of destroying the mosquito larvae in such breeding places by regularly repeated treatments with oil and other larvicides. If a light oil—fuel oil—is sprayed on the surface of water or on a swamp it spreads in a thin film over the surface and the larvae unable to get through this film to the air, perish of suffocation.

An ingenious larvicide has recently been used in the form of Paris Green (a compound of arsenic and copper); one part of this compound is mixed with 100 parts of fine road dust and sprayed on the windward side of the water. The Paris Green floats on the surface and is eaten readily by the surface-feeding Anopheline larvae, which promptly perish.

The culex larvae, however, which are bottom-feeders do not seem to be affected thereby; and the amount of Paris green used is so small that neither fish nor cattle drinking the water so treated appear to be injured.

(7) Adult mosquitoes can be dealt as follows:

The mosquitoes in rooms are generally attracted to dark corners and dark objects. They may be destroyed by soaping the hands and catching them; by the use of a fly trap, or spraying with larvicidal oil such as Flit; or fumigating the room with mosquito-sticks made of pyrethrum (ಅಕಲ್ ಕಡ್ಡಿ) or incense (lobhan-dhoop). Fumigation with powdered pyrethrum (3 parts) mixed with salt-petre (1 part) or tobacco refuse is useful. The material is spread thin on an iron pan and then lighted in several places or sprinkled on live coals. About ½ lb. of the mixture will be required for a room of 1000 cubic feet of air space.

To prevent mosquitoes from biting, a favourite preparation is made of the following:

Citronella oil	..	1½ parts
Kerosine oil	...	1 part
Cocoanut oil	...	2 parts
Carbolic acid	...	1 part.

All to be mixed well. Applied to the uncovered part of the body at night keeps away the mosquitoes. (*See also Anti-mosquito paste—under Insects and Disease*).

Finally, where none of the above methods are applicable mosquito-breeding may be controlled by stocking the waters with fish. Our common Panchax Lineatus or Millions (Gambusia affinis) is very useful for this purpose and has been widely introduced in India with helpful results. (*See also under Dietetics – Fish*).

The International Health Division of the Rockfeller Foundation has sponsored a world-wide programme of malaria control along these various lines, and its Experts have demonstrated that systematic screening, drainage or the destruction of larvae by oiling or dusting with Paris Green will effect a relatively complete control of malaria without much cost.

The question of Malaria control in India is mainly a rural problem because nearly 90% of the people live in rural villages, and the incidence of the disease in the villages is much higher, than that ordinarily found among the urban populations.

3. Dengue and Sandfly-fever

There are two fevers which are closely related to each other—Dengue and Sandfly-fever; the viruses of both are filtrable and ultramicroscopic. Dengue is conveyed by the stegomyia mosquito, while the sandfly-fever is conveyed by the sandfly. Both the fevers have a short course and in many cases the medical man has no means of telling whether the disease is dengue or sandfly fever, as there is no specific test by which the viruses of dengue or sandfly fever could be detected, and there is no uniform clinical feature which can be relied upon for making a diagnosis,

The word "dengue" is derived from the Spanish word meaning "dandy" and probably refers to the stiff dandified gait of those victims of dengue, who suffer from severe pains in the back and limbs. On this account dengue is also called "break-bone fever." The fever runs a short course, which rarely exceeds seven days and is generally accompanied by a rash; severe pains

in the back and round the joints often occur. The patient is infectious during the first 3 or 4 days of the fever; and if a female stegomyia *(Aedes egypti)* bites during this period it becomes infectious after 12 days and remains so for the rest of its life of a few weeks.

There is very little mortality, but the disease tends to spread rapidly when infection enters a susceptible community living in a place where stegomyia mosquitoes abound.

The stegomyia breeds especially in the rainy season; it does not travel far from its breeding places, so that if it is seen in houses it is certain that its breeding places are nearby. It is easily recognised, we saw, by its white and black striped legs, its jumpy and elusive form of flight, its persistence in attacks and its habit of biting in the daytime though it also bites at night.

Dengue is especially a disease of the Tropics and the sub-Tropics and the great prevalence of the disease in the coastal, deltaic and riverine areas is explained by the distribution of the stegomyia mosquito. Its epidemicity is varied, in hot countries where the range of temperature is slight and the mosquito abounds throughout the year the disease tends to persist as an endemic infection, though it may die down for long periods and then flare up again.

Dengue may be of serious importance by disabling a large proportion of the community for a time; a short outbreak occurring in troops at a critical moment might have the greatest consequences. Commercial firms are sometimes seriously handicapped when a large percentage of their staff may be disabled at the same time. Prevention lies as mentioned under malaria chiefly in the destruction of mosquito-larvae. Each householder can keep his own compound clean, free from collections of dirty water and oil any dirty ponds regularly that cannot be filled up.

4. Sandfly-fever

(Papatassi fever caused by Phlebotomus Papatassi)

Is one of the pests of North Indian plains especially during the summer months when the fly is most in evidence.

Since it has been shown that sudden outbreaks of a short

fever unlike ague, prevail every summer in various parts of India and that these attacks only occur where sandflies abound it is clear that many of the short febrile ailments hitherto diagnosed as Influenza, dengue or ague or attributed to chills, touch of the sun, over-exertion, indigestion etc. are really brought about by the bite of the sandfly.

The symptoms of sandfly fever are practically the same as in dengue except perhaps that the rash is much more rare in sandfly fever.

Prevention. Systematic prevention is of importance when an epidemic would embarrass, for example military operations.

The ordinary method of prevention is by the use of mosquito net of much finer mesh than that used to prevent mosquitoes. Mulmul nets are safer, but have the disadvantage of keeping out air also. General cleanliness of the house and its surroundings, disuse of matting, painting and varnishing of doors and windows and prevention of soiling of the ground with human or animal excreta etc.

Spraying the room with one per cent solution of Formaldehyde will clear out the sandflies. Flit and such other preparations are effective also. Neatness and tidiness of the surroundings of the house help to reduce the number of sandflies. The upper storeys of houses are much less infected than the lower.

5. Kala-azar

The name Kala-azar meaning 'black-fever' was in use in Bengal and Assam long before the nature of the disease was known and it is likely that the disease had existed in India for Centuries. In recent years in 1882 it was first described as a chronic form of malarial fever, which was depopulating the Garo Hills of Assam, but it was soon observed to be spreading up the Southern Bank of the Brahmaputra River along the main lines of communication. As the epidemic wave advanced to a new locality the disease gradually died out in the first-attacked tracts.

The disease occurs as an epidemic over wide areas in Assam, Lower Bengal and Bihar and East part of United Provinces. It is not known in the North West of India or in the Bombay

Presidency and Central Provinces, but it occurs in Madras City and a few restricted areas of the Madras Presidency.

Kala-azar used to sweep through the tea-gardens of Assam in terrible epidemics and until a means of treatment was discovered was an extremely fatal disease.

In 1903 Leishman and Donovan of Madras working independently found the organism of the disease—a flagellated protozoon in spleen-puncture-fluid taken during life of patients suffering from Kala-azar, which was until then thought to be a form of malarial cachexia.

The chief feature of the patient suffering from Kala-azar is his great emaciation contrasting with protuberance of the abdomen from enlargement of the liver and the spleen. The face has often a dusky appearance. There is persistent fever, anaemia with dropsy of the feet and abdomen. Dysentery and Broncho-pneumonia are the terminal infections which end the scene.

The lingering nature of the disease and its very high mortality render it one of the worst human maladies.

The mode of transmission of the Kala-azar organism has puzzled medical workers for many years. Recent work, however, at the Calcutta School of Tropical Medicine points to the sandfly (Phlebotomus Argentipes or silver-footed or white-legged sandfly) being the carrier. As this fly lays its eggs in dark places like the floors and walls of latrines, the dirtier part of compounds especially where the dejecta of fowls and ducks abound should be kept clean. Attention to cleanliness of such places may therefore, be the most important step in the prevention of Kala-azar.

A closely allied disease—Oriental Sore, or Dehli Boil—occurs in many Tropical Countries, in the Northern Part of India, in Persia, Mesopotamia and Palestine. It is probable that this disease is carried by the phlebotomus papatassi, the common variety of sandfly occurring in Northern India.

6. Filariasis

Another important mosquito-borne disease of the Tropics is Filariasis, due to infection with various species of thread-like

worms belonging to the genus, filaria. The most serious is Filaria Bancrofti, which is very common in South China and India, the Pacific Islands and the West Indies and is endemic in most countries. The infection is transmitted by mosquitoes belonging to the genus culex and Aedes.

This disease has been described under the heading 'Parasites' and also the method of prevention. *(See page 333)*.

7. Yellow Fever (Yellow Jack, Yellow peril)

Is another insect-borne disease which must be considered on account of its world-wide importance and the dramatic story of efforts which have been made to control it. Though it does not occur in India an acquaintance with its cause and mode of spread is essential, because it is a terribly fatal disease, and should it be brought to India the consequences might be tragical. It is a disease of sea-ports, particularly of the Tropical Ports of Central America, especially on the Eastern Coast line. It also occurs in the Coastal areas of West Africa, from whence it is supposed it was exported to America in the days of the Slave Trade. In these areas it has killed thousands of people especially new comers, and under the name of Yellow Jack was a terror to all the crew of merchant ships that had to visit Cuba and the areas bordering on the Gulf of Mexico.

Yellow fever is characterised by high fever and prostration and jaundice with vomiting of blood.

The mode of transmission was a mystery for a long time until Manson's work on Filariasis led to the mosquito being suspected. The proof of this was forthcoming by the brilliant and self-sacrificing work of an American Commission headed by Reed, who by experiments on themselves and others proved that the disease was conveyed by the Stegomyia fasciata (aedes Egypti), the same mosquito that carried dengue fever in India. The patient is infectious during the first 3 or 4 days of the fever; and the female mosquito becomes infectious 12 days after biting and remains so for the rest of its life.

These experiments gave the clue to the prevention of the disease; and General Gorgas was able to banish yellow fever

from Havana. His lead was taken up by other Countries and Cities, and the Rockfeller Foundation has done magnificent work in assisting Countries, Cities and Towns in the affected areas to banish yellow fever in many cases or to reduce it to a negligible factor.

In 1904 Gorgas repeated in the Panama Canal Zone his previous success in Havana, and yellow fever was and is practically absent from the Canal Zone areas. Its absence, infact, along with the anti-malarial measures adopted made the construction of the Panama Canal possible. The Isthmus was the "foremost pest-hole" of the Earth "infamous for its fevers;" and the failure of the French to build the canal under Mons. de Lesseps of the Suez Canal fame, was chiefly due to the fact that nearly one third of the working force died each year from yellow fever alone.

A comparison of the deaths among the American Canal Builders as compared with that among the French indicates a saving of nearly 10,000 lives.

Yellow fever does not exist in India, but the stegomyia does. It is a serious matter of concern whether it is possible for yellow fever to be brought to India. The facts of its transmission make it unlikely that cases within the first three days of illness or infected mosquitoes will likely be brought to India; but with the opening of the Panama Canal and the increase of rapidity in communication, the increased facilities for travel offered by the automobile and the air-plane make the danger from yellow fever to India and the rest of the World a constant and imminent one.

The measures for the control of yellow fever are theoretically simple: Prevent any breeding of the stegomyia. Regular inspection and treatment of all domestic collections of water should be done. Cisterns and barrels for rain water are covered and stocked with small fish (panchax lineatus) which prey on any larvae that may appear.

8. Relapsing Fever

(Spirillum fever, Famine fever)

Relapsing Fever in India is a severe disease which occurs in epidemics occasionally in Bombay, the Punjab and the United Provinces, and along the lower hills of the Himalayas; but the

plains of Bengal seem to be free. A few years ago there was an epidemic of this disease in the South Arcot District of the Madras Presidency.

It is characterised by high fever, chest affections, diarrhoea and jaundice. The fever is so called as persons attacked get relapses of fever a few days after the first attack has subsided. It is produced by a spirillum, a spiral form of organism present in the blood of the patient and which is carried from patient to patient by the louse. The organism was discovered by Carter in Bombay in 1887 and its mode of transmission in India by the louse has been confirmed by Mackie and Cragg.

Relapsing fever is also called Famine Fever, because it has been associated in the past with many of the great Famines in India.

Its prevention is obvious—get rid of the insect parasites which convey it. Disinfection of the clothes gets rid of the body louse. Boiling the clothes with water or steaming is sufficient to kill even the eggs.

During the Great War a vermicidal paste consisting of,

Naphthalene	...	96 parts
Creosote	...	2 parts
Iodoform	...	2 parts

was largely used and was found efficient but its smell was a great drawback.

To get rid of the head louse the hair should be cut short; if this is not possible the adult lice and their nits (eggs) may be killed by soaking with kerosine oil for half an hour, taking care not to have fire or smoke in the neighbourhood. Weak acetic acid or pure vinegar applied to the hair dissolves the sticking matter of the nit and dislodges them easily when the soaked hair is combed.

9. Typhus Fever

What is ordinarily known as Typhus fever outside India and the Tropics is a form of exanthematous fever (i. e. fever accompanied by a rash on the body) like smallpox, measles etc. characterised by a specific form of rash. It is not very common

in India except in the coldest North and the Hills of the Punjab. It is spread by the **louse.**

There is another variety—Tick typhus—described by Megaw. There is always a history of having been out in the jungle often for shooting; and in several instances there has been a definite history of the patient having been bitten by a tick.

The disease shows itself by fever for about a week or 10 days and the development of rash characterised by fairly large red blotches or spots over the body. The disease has been found in the Kumaon Hills, the C. P. and Darjeeling Hills.

There is probably a large number of fevers in the Tropics—classed as Typhus group of fevers—transmitted by various insect-vectors like the mites, the ticks and the lice.

10. Trypanosomiasis

(Sleeping sickness of Gambia; African Lethargy)

A chronic disease of Tropical Africa caused by protozoal parasites, (Trypanosoma Gambiense and T. Rhodesiense) which are the transmitted by the tse-tse fly (glossina palpalis, and glossina morsitans). (Fig. 21)

Rosenau rightly states that next to the malarial parasites the trypanosomes are man's most deadly protozoan enemies. In one district of Central Africa the population was reduced from 300,000 to 100,000 by Sleeping Sickness in the period of seven years.

The disease is characterised by long continued fever with enlargement of spleen and lymphatic glands in the early stages; later there is somnolescence and other nervous symptoms from involvement of the central nervous system. It usually terminates after a protracted course sometimes of several years, in death unless efficiently treated in the early stage.

The disease has been known as sleeping sickness of Tropical West Africa for over a century, but the infection failed to establish itself among the African slaves imported into the Western Hemisphere, because of the absence of the tse-tse fly, which is limited to Africa only. With the opening up of trade route in Central Africa Sleeping Sickness appeared in 1903 in an

Epidemic form on the northern shore of the Victoria Nyanza Lake in the Uganda territory and carried off a large proportion of the people within the next 10 years.

It was at this time that the disease was investigated into and was recognised by Dutton to be due to a trypanosome, a protozoan parasite. Some of these cases were followed for sometime and found to eventually develop the cerebrospinal infection and die of typical sleeping sickness; Castellani in 1903 observed in the cerebrospinal fluid of a case of advanced sleeping sickness in Uganda a trypanosome having the same characteristics as that described by Dutton.

It was thus established that the endemic mild fever described by Dutton in West Africa was the same as the early stage of the epidemic Sleeping Sickness of Uganda. In the latter place the disease had spread very rapidly because of the abundance of the tse-tse fly in the lake shore and probably also because the disease found a virgin soil in the previously uninfected people of East Africa.

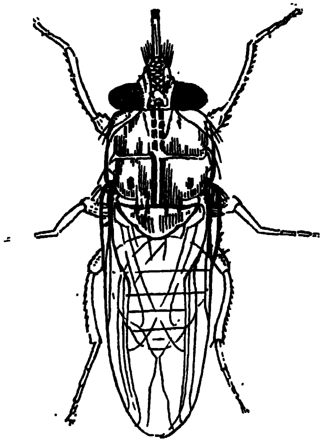


Fig. 21
Tse-tse fly (Glossina Palpalis)

Tne trypanosomes belong to the class of protozoa, which are parasitic in many species of animals, birds and squirrels in Africa and elsewhere. They are elongated uniflagellate organisms, multiply by division along the length and can be seen in fresh blood specimen as actively moving bodies causing great disturbance of the red blood cells in the field of the microscope. The trypanosomes are also present in larger numbers in the enlarged glands especially of the neck.

The tse-tse fly is found only within a short distance of water. It also likes shade, so that forest-clad banks of rivers and

lakes are its regular haunts where both man and animals coming for water are liable to be attacked by these flies. It does not lay eggs, but the larvae are developed in the ovary and thrown out.

The tse-tse fly may convey the trypanosomes directly by mechanical transmission of parasites, which adhere to the proboscis of the insect, and in some cases a cycle of development of the parasites is said to take place in the alimentary canal of the insect, from where they are directly injected into the blood of the animal by the bite of the fly.

Prevention. Although the treatment of the disease is known the fundamental control of trypanosomiasis is extremely difficult. The tse-tse fly larvae pupate in moist soil, and clearing away the brushwood in the neighbourhood of streams and of settlements so that the soil dries out, will considerably diminish their numbers. The isolation of human carriers has proved of value in certain areas.

11. Asiatic Cholera

Cholera is one of the most dreaded of Tropical ailments and is easily recognised by the fact that the patient passes copious colourless stools, which look like the water in which rice has been boiled, and also vomiting. It is an infectious disease, the outcome of filth and filthy habits and is easily preventable by a due recognition of its causation and mode of spread.

The infecting agent is the "Comma" bacillus (cholera vibrio) of Koch. The microbes are naturally pathogenic for man only. They enter by ingestion with food and drink and produce their lesions mainly in the intestinal tract, particularly the lower half of the small intestines, where the medium they live in is mainly alkaline. They do not ordinarily survive in the stomach, as in the healthy condition of that organ the secretions are markedly acid and this acidity is quite detrimental to their growth.

The vibrio dies in a few hours when dried in air at room temperature; in privies they are usually dead within 24 hours. In the foeces of patients the vibrios may multiply at first, but usually die off in 2 or 3 days, and are supplanted by other

bacteria. In rare instances the cholera vibrios have been known to be alive for 20 or 30 days and in one case for 120 days. In impure water they usually die in 6 or 7 days; in stagnant water they have been found for 18 days, and in the mud at the bottom of an aquarium they were found several months after the infection. . In sterile milk they may live 8 or 10 days, but in unsterile milk they are soon destroyed by the acidity produced by the growth of the lactic acid forming bacilli. It can, therefore, be said that the cholera vibrios do not survive in sour milk like curds and butter milk.

In ice they may remain alive for a few days but after several weeks of storage no viable vibrios are found in the ice.

The vibrios are killed in moist heat at 56°C in half an hour, and at 95° or 100°C they are killed in one minute.

The conditions favourable for the growth of the vibrios are a warm moist temperature of blood heat, the presence of oxygen and organic material.

In the past there were several pandemics of cholera, which usually arose in India and followed the course of trade routes and human travel. The disease has been practically eradicated in countries with adequate sanitation and an effective maritime quarantine service. At present the disease is limited chiefly to tropical countries particularly Southern Bengal including Calcutta, and to countries with inadequate sanitary control and quarantine. It had prevailed for years in the Philippines until it was recently controlled.

The spread of cholera in India is often associated with large pilgrimages, such as occur in Hardwar, Allahabad, Nasik, Puri and Gangasagar during the Melas and festivals. During the last few years however, the precautionary measures taken at these large concourse of people have resulted in the great diminution of the disease both at the melas and in its spread outside by the movements of pilgrims. For example, in the 1938 epidemic of cholera in India the number of recorded attacks in British India up to December 24th 1938 was 320,000, and the deaths 154,000; the worst affected provinces being the U. P. and Bengal. The Punjab which had been free during the 1st quarter

reported during the year 9000 cases, of which 5000 were deaths. The epidemic seems to have started about the end of March and spread rapidly from U. P. during the Kumbha-mela to different parts of the country. In the C. P. particularly during the 3rd part of the year the epidemic was intense and by the end of the year in most areas the epidemic had either disappeared or had very considerably decreased. "India, however, unhappily still continues to live up to its evil reputation of being the important world-reservoir of Cholera infection."

Individuals are not equally susceptible to the disease. Numerous individuals are infected who do not develop Cholera. As a result there are many individuals with the cholera vibrios in their stools, who never had symptoms of the disease. The resistence of an individual seems to depend in part upon the general good health and the absence of gastro-intestinal disorders. Healthy "carriers" are known to have developed cholera after gastro-intestinal upsets following indiscreet drinking and the like. After recovery a kind of temporary immunity is established. Similar immunity can be produced by vaccination with the killed cholera microbes.

Transmission. The source of the vibrios is the foeces of patients and of carriers. During the acute stage of the disease the vibrios are present in the foeces in almost pure culture. As the individual recovers the bacilli in the foeces decrease. The vomit may also contain the micro-organisms. The portal of entry is the mouth. The bacilli may reach the mouth of an individual by direct contact with an infected person or with contaminated discharges and objects, or by ingestion of contaminated food and water. Since the vibrios die quickly when dried in air infection is rarely ever produced by dust or other dried objects contaminated with the vibrios.

The common habit prevalent in India of people frequenting tanks and river banks in order to obtain water for washing their person after attending to calls of nature in the neighbourhood is mainly responsible for the contamination of water with the germs of Cholera and the subsequent spread of the disease.

Flies may be a factor, as we have seen, in the transmission

by the mechanical transfer of the Cholera germs to water and food. Contamination of general water-supply from dejecta on the soil, in the privies or in sewage may produce a wide-spread epidemic of Cholera.

Healthy Contact-Carriers are fairely numerous. They not only disseminate the infection, but are potential causes of Cholera, which develops whenever their resistance—power is temporarily lowered. In many exposed individuals the infection may produce such mild symptoms that the condition is overlooked. These individuals are dangerous sources of infection.

Cholera patients excrete the organisms for a few days or weeks, usually for 7 to 14 days; in a few instances the bacilli may be found in the foeces as long as 3 months after recovery from the disease.

The incubation period of Cholera is from 1 to 5 days, usually 3 days. Prolonged incubation period of 16 to 18 days has been reported in cases where a healthy carrier-stage preceded the development of symptoms.

Control of Cholera. The measures of control are based on the fact that the vibrios are excreted by the foeces and produce infection by way of the mouth. The early recognition of the disease and the detection of carriers are very important. This is generally done by the microscopic examination of the foeces and detection of the Comma bacilli in it. The finding of the vibrios is only presumptive evidence of Cholera infection as there are numerous non-pathogenic organisms exactly resembling the Cholera vibrios in their shape, structure and in cultural characteristics. This observation has lately been confirmed by the Indian Research Fund Association, whose report says "there are in nature many organisms which resemble the Cholera organism but do not cause the disease." This has a practical bearing on the use of Cholera Vaccine as a preventive measure, as it is of the greatest importance that the vaccine used for protection against Cholera should be prepared from **"the genuine Cholera organism."** For an undoubted diagnosis serological agglutination tests are sometimes necessary.

The patient should be isolated in a separate room or in a

hospital. There should be prompt and thorough disinfection of stools, vomit and all things that might be contaminated by the patient. For disinfection of the stools and vomit strongly alkaline milk of lime is excellent. Formalin solution (10 p. c.), Carbolic solution (1 in 20), Lysol (3 p. c.) or Bleaching powder (sol. 3 p.c.) may also be used.

Remnants of food and offals of the patient should be burnt; linen should be boiled or soaked in lysol or carbolic acid solution.

The hands of the attendant and nurse should be disinfected by washing in 1 in 1000 perchloride of mercury or 1 p. c. lysol. Separate cups and dishes should be set aside for the patient and should be scalded (with boiling water) after use. The patient should not be released from isolation until three successive examinations of the stools under the microscope have proved negative for the germs.

For "**terminal**" disinfection, that is, disinfection after recovery or death of the patient, the furniture, floor and walls should be washed with 5 p. c. carbolic or 2 p. c. lysol, and soap and water. Those who die of the disease should be cremated or wrapped in a sheet wet with a disinfectant and buried in water-tight coffin or in ground away from a water course.

Attendants, nurses and doctors must exercise special care to escape infection. They must disinfect their hands after handling the patient, his dejecta or any contaminated article from the patient. They should not be allowed to handle foods other than those needed for themselves and their patients.

All contacts should be quarantined for 5 daye from their last exposure. Their stools should be examined to make sure that they are not "carriers." Carriers must also be isolated and their stools should be disinfected. They are not free from infectivity until two successive examinations of their foeces under the microscope prove negative.

In endemic and epidemic areas all water should be boiled before it is used for drinking or even washing purposes unless it is safeguarded by other adequate measures. The provision of a pure water supply and its protection from contamination has

been dealt with elsewhere, but reference may be made to permanganate of potassium as a means of rendering suspicious source of water safe, especially wells; the rule to be adopted is to add sufficient permanganate to make the water in the well distinctly red, so that it does not recover its normal colour (or rather colourlessness) for 8 hours. If this is done in the evening the water is ready for use the next morning.

Chlorination may be done to purify the water either in the house or on a large scale as in jails and hospitals and may be carried out by the use of bleaching powder or by chlorogen or E. C. Fluid.

In all Tropical communities where a plentiful and safe water supply has been provided and efficiently guarded against pollution the disease has been practically eliminated; but recent observations have shown the importance of protecting food supplies also from contamination.

Hence the food supply must also be carefully supervised when cholera is present. Only cooked food should be eaten. Fruits should either be cooked or carefully washed and pared and only the pulp eaten. It is obviously important to safeguard cooked food and clean disinfected water and milk from contamination by flies and infected fingers.

Normally the contents of the stomach are acid from the presence of the gastric juice, and if cholera germs are introduced into the stomach of a perfectly healthy person the cholera germs may be immediately killed. If, however, that person is suffering from dyspepsia and his stomach is full of alkaline mucus instead of the acid juice, or if he be suffering from diarrhoea and the cholera germs are hurried on into the intestines before the gastric juice has a chance of acting on the germs they are not killed, but may grow and multiply, and an attack of cholera be the result. Hence during an epidemic of cholera never eat rich or in digestible food; avoid unripe or over-ripe fruits which are likely to cause diarrhoea. Treat all cases of diarrhoea atonce, do not take purgatives, especially Salines, like Siedlitz powder, Epsom salts, Glaubers salts or evèn Eno's Fruit-salts and similar preparations.

At all Ports a maritime quarantine service should be organised to quarantine individuals coming from endemic or epidemic areas and for bacteriological examination of stools. By aggressive preventive measures the introduction of cholera from without has been prevented in many countries. Where a few cases do develop the spread of disease can be effectively checked by rigid measures of sanitation, isolation and surveillance.

Prevention. It may be well to mention here about what are known as "bacteriophages" first described by Dr. d'Herelle. These are ultra-microscopic substances which have the power of disintegrating and killing bacteria. They exist normally in the intestines, and when a person gets infected with any of the bowel complaints, such as cholera or dysentery or typhoid fever, the bacteriophages develop some sort of activity towards the microbes of these diseases and kill them, and the person recovers; the convalescent, more over, discharges bacteriophages in his stools and infects water supplies with the bacteriophages so that as the epidemic of the disease progresses people drink water with bacteriophages in it and get protected; the epidemic then slowly dies down.

Bacteriophages active to cholera have now been made on a large scale by Asesoff at Patna and Morison at Shillong and have been used both as a curative and preventive agent in Epidemics of cholera at the various North Indian melas and with a certain amount of success.

Preventive Inoculation was first introduced on a large scale in Calcutta by Haffkine. Haffkine's vaccine consists of an emulsion of cholare vibrios killed at suitable temperature, and when injected produces a temporary immunity lasting from 6 to 8 months, which is fairly sufficient to tide over the period of danger. Operations in Java, Siam, Bengal and Madras and also among Haj pilgrims have undoubtedly proved the efficacy of the inoculation as a preventive measure. The inoculations are painless and produce slight or no reaction. The vaccine is produced at the Haffkine Institute, Kasauli, and can be had privately from any individual. Exposed individuals should get themselves inoculated every six months.

Another effective preventive remedy is "Bilivaccine" for cholera. This consists of killed cholera organisms pressed into small tablets and have to be taken by the mouth. One tablet each time preceded by a capsule of vegetable bile, on three successive days the first thing in the morning. The immunity conferred by bilivaccine cholera is also sufficiently lasting, it is said it lasts for nearly a year. But Russel considers that inoculation is more beneficial.

12. Typhoid and Paratyphoid Fevers (Enteric Group)

Enteric fever is one of the most formidable diseases with which we have to deal in India, not only on account of its large prevalence and high mortality but on account of the expensive sanitary measures considered necessary for its prevention.

To appreciate the importance which the Military Authorities attach to the prevention of spread of this disease in the army one has to take into consideration the fact that prior to 1900 the disease used to be very common in army camps and barracks and killed more soldiers during war-times than gun powder; about 10 to 20 p. c. of the soldiers used to get the disease with 15 to 20 p. c. deaths. Owing to improved sanitation and prophylactic immunisation the incidence of the disease among the American Soldiers mobilised during the Great War numbering 4 millions was only 0.03 p. c. with very few deaths.

Typhoid fever is, as is wellknown, characterised by continuous fever lasting usually for 3 weeks and usually accompanied by persistent diarrhoea, the stools having the characteristic pea-soup colour and consistency. The infecting agent is the Bacillus Typhosus and its characteristic effects are localised changes in the Intestines.

Individuals may be infected without manifesting signs or symptoms of the disease; in such cases either the disease is very mild—ambulatory form of typhoid, as it is called—or the bacilli invaded the host and showed no outside manifestations. The typhoid bacilli are killed even by a few hours' drying; a few of them might however survive and die during the next few weeks. They are readily killed by a temperature of 65°C, much lower than the temperature of boiling water.

Typhoid fever is seen in all parts of the world particularly in the Temperate Zone and is most common where insanitary conditions prevail. For this reason it is most prevalent in villages owing to poor sanitary conditions.

The incidence of typhoid fever is greatest between the ages of 15 and 25 or 30. Outside this limit it is rarer.

Individual susceptibility and exposure to infection are important in the production of typhoid fever. After a single ingestion of a few bacilli into the body individuals in good health do not usually become ill, while those in poor health or suffering from privation, over-exertion, or exposure to heat and cold as occurs among soldiers at the War-front, may succumb to the disease. Usually it is only after repeated exposure to infection that most people develop the disease.

One attack of typhoid fever confers as a rule a considerable degree of immunity against a second attack; and if a second attack occurs it is usually mild.

An attack of Typhoid fever does not, however, produce immunity against any of the "paratyphoid" fevers. These are more or less similar to typhoid fever but less mild and are caused by a particular form of bacilli, paratyphoid A and B. This is one reason why as a prophylactic inoculation a combined serum is always used - called the T. A. B. vaccine—a triple vaccine immunising against typhoid and paratyphoid A and B.

We said that paratyphoid is similar to typhoid and is much milder, and is less fatal also; the method of transmission, however is the same as in typhoid.

The original source of the bacilli is an infected individual either a patient or a 'carrier'; the latter, we said, may not manifest outside any signs or symptoms of typhoid or paratyphoid fever. The portal of entry of the bacilli is the mouth, the bacilli reaching the mouth by contact with contaminated articles and infected fingers or by the taking in of contaminated water, milk and various foods. Oysters grown in estuaries in which sewage of a town has been allowed to flow have been known to harbour typhoid bacilli and convey them to the consumers.

The patient—a source of infection. The most important

sources are the foeces and urine of patients suffering from typhoid. The bacilli have been isolated in the foeces and urine not only during the continuance of the fever, but even for weeks after convalescence; and in a small percentage of cases of recovery the person remains a chronic carrier, as the bacilli may be excreted in the foeces and urine for months, or even years.

According to Dr. Woods Hutchinson "the cause of enteric fever is simplicity itself, merely eating or drinking the excreta of some one else. "Eating dirt" is the popular phrase: simple, but of deadly effectiveness and disgracefully common."

In cases of typhoid complicated with pneumonia numerous typhoid bacilli may be present in the sputum also, and this becomes an important source of infection. In fact all discharges from typhoid fever patients may be infective. Care should, therefore, be taken not only with the disposal of urine and foeces but also with other discharges of the patient.

The carrier is a dangerous source. There are "contact" carriers and "convalescent" carriers. The convalescent carriers are those who have had typhoid fever, a small percentage of whom might become chronic carriers, some for years and a few for life. The contact carriers are those who never suffered from typhoid fever and exhibited no signs of the disease or had no known exposure to the infection.

The typhoid carriers are of great importance in the spread of infection. They are largely responsible for the endemic cases in communities with modern methods of sanitation, and with adequate regulation of water and milk supplies and satisfactory disposal of sewage. These carriers are also responsible in some instances for epidemic outbreaks; in fact, they are a terrible menace, especially those who handle food supplies as in the case of cooks and butlers. The case of "Typhoid Mary" who was known to have been responsible for several outbreaks of typhoid fever over a period of 20 years in homes and boarding institutions at which she was employed, is a good example of the danger to the community from these carriers.

In another instance an outbreak of several hundred cases

was traced to the infection of milk by a "carrier" who had had the disease 47 years before.

Thus, the bacilli may be transmitted by direct contact with patients or carriers and their discharges, and by the ingestion of infected water, milk and other foods. The infected fingers of nurses, orderlies and doctors and of servants may not only infect themselves but also others in a household particularly if they handle food. The disease might also spread through water, ice, milk and other foods and through the agency of flies, through dust and through soil contaminating the drinking water supply as in villages.

Prevention and control of Typhoid fever. *A.* The bases of control are the prevention of the spread of the bacilli and the use of prophylactic inoculation of T. A. B. vaccine. The resistence produced by immunisation is only temporary and usually lasts about 6 months. The important thing to remember in the control of typhoid fever, in fact all preventable diseases, is that inoculation does not do away with the need for sanitation and precautions against exposure to infection and to conditions of privation or fatigue.

Bilivaccine (Typhoid and Paratyphoid A and B). Besredka found that oral administration of dead typhoid and paratyphoid bacilli was quite harmless and the resulting immunity was as effective and as rapidly induced as by the subcutaneous inoculation of the same bacilli. Bilivaccine typhoid and paratyphoid A and B, is given on 3 successive days (as in the case of cholera bilivaccine) before breakfast; before the administration of the vaccine a capsule of vegetable bile is also admtnistered to facilitate the action of the bacilli.

In view of the effectiveness of inoculation which is accompanied by no danger whatsoever it should be used in all who are exposed, such as attendants, nurses, doctors, members of the family of a carrier, individuals in epidemic localities, travellers, pilgrims, soldiers etc.

B. **1. The Patient.** The diseased individual should be isolated at the first suspicion of the disease without waiting even for confirmation by the microscopic tests. He may be kept in a

screened room at home if adequate conditions are available for satisfactory concurrent disinfection. Otherwise it is advisable to remove him to a hospital. All excreta, discharges and articles soiled by him should be carefully disinfected. Separate eating vessels must be provided and those should be boiled after use. All remnants of food should be burned. Bedding, sheets and all fabrics in contact with the patient should be boiled. Bedpans and urinals should be of glass or earthenware and should always contain a liquid disinfectant before and after use. Doctors, nurses and attendants should disinfect their hands after handling the patient or his discharges. Those in constant contact with the patient should not handle food other than that used for themselves and the patient.

The concurrent disinfection should be continued until the stools are negative at two successive examinations conducted once a week. After recovery the room and its contents should be carefully washed with soap and disinfectant solutions.

2. **The Carrier.** It is a difficult problem to detect the carriers and to regulate their activities and movements. Detection may be extremely difficult, because the excretion of bacilli is intermittent and as a consequence the results may be negative in a really "dangerous" carrier. Much can be done in regulating the activities of carriers. They should be instructed in personal hygiene and excluded from food-handling. In most countries the carriers are registered by the Health Department and kept under parole; but it must be mentioned it is very difficult to control them effectively, because they break parole and surreptitiously handle foodstuffs. The case of "Typhoid Mary" is a good example of unwarranted negligence. If the guilty carrier is apprehended the only effective remedy is detention and treatment by vaccine T. A. B.

3. **General Measures.** Most important in typhoid control is the safeguarding of the water supply. This involves purification of the water supply, prevention of water pollution and supervision of the bathing places especially tanks and rivers. Defects in the purification process and in the distribution of the water are important in causing all "water-borne" diseases-out breaks in

large communities. By an adequate inspection of the water supply and educational propaganda much can be done to supervise the location of wells and the prevention of surface contamination; and contaminated water supply should never be used unless adequately disinfected or **boiled** before use.

Important in typhoid control is safeguarding of the milk and food supplies. This involves supervision of the production, transport and distribution of foods. The danger of milk and milk products of infection can be eliminated by pasteurisation; and in milk-borne epidemics suspected milk supplies should not be allowed to be sold until the source of the infection has been detected.

Food supplies should be supervised especially shell-fish and oysters. Human excreta should not be used for fertilising the soil.

The disposal of sewage is a vital question. Human excreta and waste products should be disposed of in such manner as not to contaminate the water supply and bathing places.

Fly-breeding should be prevented by domestic cleanliness and personal hygiene. Educational propaganda vigorously conducted can do much to reduce fly-breeding.

Prophylactic Immunisation should be encouraged particularly among tourists, Doctors, nurses, attendents and all others exposed to infection,

13. Tuberculosis

Tuberculosis is a disease of such far-reaching social and economic importance as to constitute one of the principal objectives of our public health programme; and its high incidence among young, adult and children and the large mortality from the disease enhance the bitterness of its tragedy and the heaviness of its economic loss.

Tuberculosis—otherwise known as the White Plague as opposed to the Black Death or plague of the middle ages—is one of the most terrible scourges of cur Country, nearly one million people dying every year and perhaps as many as 5 millions showing signs of the disease. Children are affected more than

adults, and women more than men, the death-rate among women of child-bearing age being nearly 6 times that in males. With regard to expectant mothers with tuberculosis 42 p. c. die within the first year of child-birth, 50 p. c. die within the second year, only 8 p. c. thus escaping death within the second year of delivery. Statistics show about 1200 deaths annually in Madras City among the population in general. This is certainly a modest figure and it is estimated that nearly three times this figure is the true mortality rate. The death rate in some of the large Indian towns like Cawnpore, Calcutta and Lucknow and Rangoon is very high, as much as 4.5 per 1000 of the population; and there is a concensus of opinion that in those towns the highest mortality occurs in young Mahammadan women, majority of whom are Ghosha people accustomed to live in overcrowded and ill-ventilated localities, where often there is not even a sampling of sunshine during the day or fresh air althrough.

The disease is an ancient malady. Early Egyptian Mummies and even the skeletons of the neanderthal man show evidence of its prevalence, especially the "**surgical**" form of Tuberculosis affecting the bony joints and the spine. The germ of Tuberculosis was discovered by Koch in 1882; since that time we have learnt much about the disease and have come to realise that its causation and mode of spread is no simple problem.

There are some factors which play a part in determining whether a given individual shall or shall not suffer from Tuberculosis:

(1) **The Germ.** Obviously tuberculosis cannot exist without the causative tubercle bacillus; and the tubercle bacilli which ordinarily cause disease in man are of two distinct types—of human and bovine origin respectively. The human type is almost invariably associated with lung affection, known as "consumption" in popular language; while the bovine type is frequently the cause of tuberculosis affecting the lymphatic glands of the neck producing "Scrofula," bone, joints, the spine etc.—known as Surgical Tuberculosis—and especially affecting children. The bovine form is mostly communicated through the milk and butter of tuberculous cows; while the human form

through sputum of consumptive patients. Indiscriminate spitting, a common habit of people, is a fertile means of spreading the infection.

(2) The presence of the infective agent alone is by no means the sole factor in the production of the disease, in fact of any disease. In a group of people with high natural susceptibility and little resistance—power, tuberculosis does indeed behave like a true communicable disease. Among certain Indian and African Troops in France during the Great War tuberculosis spread like an epidemic disease.

(3) Among young children in all communities exposure to infection is a major determining factor, but among adults the actual development of the disease is primarily due to lowering of the power of resistence to disease rather than to particularly heavy infection.

(4) Tuberculosis is not primarily and essentially a hereditary disease, i. e. tuberculosis is not transmitted from parent to offspring as disease, but only the susceptibility to the disease is transmitted, and it is possible that similar environmental conditions and exposure to infection in the susceptible years of infancy do also play a part in the transmission of the disease from an infected parent to the child.

(5) It is possible also that the power of what is known as the "Natural Selection" plays an important role in developing resistent stocks amongst certain races long exposed to the ravages of tuberculosis.

(6) Mal-nutrition or under-nutrition, want of sunshine and fresh air, over-crowding, insanitary surroundings—all these tend to lower the vital resistance of the body to all diseases in general and to tuberculosis in special. Though we may not know what is actually meant by this vague term, vital resistance, we do know how it operates and how it can be controlled; we know that in the case of an individual suffering from tuberculosis the disease-process can be checked in a majority of instances by following the rules of hygienic living, and we may be quite sure that the same procedure which will control the disease-process when well developed, will even more surely check it in its inception.

We have ample evidence in this respect that the apalling increase of tuberculosis in Central Europe after the Great War was due to malnutrition brought about by war-conditions.

Hereditary susceptibility we cannot control, but the factors of infection, of simple immunity and of vital resistance—all offer possible channels of approach to this important problem.

(7) Certain habits, the tobacco habit, alcoholism, sexual excesses—these are drains on the nervous system, which is the basis of all vitality. Certain social customs, such as the Purdah System among women, early marriages etc. also contribute largely towards the lowering of vitality, the latter especially of the entire race in the long run.

Repeated pregnancies and want of "spacing" of child birth, consanguinity of marriage (i. e. marriage between blood-relations) all tend to lower the bodily and mental tone and predispose to disease.

Prevention The control of tuberculosis obviously involves two distinct problems:

(1) Protection against bovine infection

and (2) Protection against human infection.

Our safe-guard against bovine infection must be sought primarily in pasteurisation of milk or atleast boiling it before use. Pasteurisation or boiling is essential as a protection against other diseases also, such as typhoid fever, cholera, dysentery and scarlet fever transmitted through contaminated milk.

The human type of tuberculosis—pulmonary tuberculosis (i.e. affecting the lungs) or phthisis—is derived wholly from human cases of consumption, and the infection is generally due to rather direct transfer of fresh sputum by direct contact, by mouth-spray during coughing, sneezing etc.—"droplet infection" as it is called as usually occurs in the spread of diseases like the common Cold, influenza, diphtheria, pneumonia, measles and smallpox. Infection may also occur through objects recently handled by the patient.

The role of infected dust in the spread of Tuberculosis has been exaggerated. We can find tubercle bacilli in the dust of rooms occupied by a careless consumptive, but their numbers are

exceedingly small. The real reason why indiscriminate spitting is dangerous is that infection from fresh sputum may be spread by contact, shoes, flies or in other ways, rather than through the few bacilli which survive after the sputum has dried and which may be blown about as dust.

The expectoration of sick persons should, therefore be received in a closed vessel containing a disinfectant and should be systematically disposed of by burning and never buried or thrown about on the ground.

In the control of human infection our primary basis must be a knowledge of the infected individual. Hence it is necessary that Tuberculosis should also be made a notifiable disease. The recognition of early cases of the disease is the fundamental essential for the success of our attempt at prevention; because on the one hand it is a primary factor in checking the spread of infection to new individuals, and on the other it is equally vital in checking the progress of the disease in the already infected by applying appropriate means for the up-building of the individual's vital resistance.

Fortunately the tubercle bacillus is a delicate bacillus easily destroyed by desiccation or sunlight. Hence if a consumptive who is careful about his sputum and cleanly in his habits is put in a well-lighted and well-ventilated room there will be little danger of any other members of the family contracting the disease. Hence it is not necessary to isolate the patient. But if, on the other hand, the patient is crowded up with others in a dark ill ventilated dingy place then sooner or later other members will infallibly fall a prey to the disease, keeping the disease alive in the family indefinitely. The careful consumptive is therefore not a menace, and it is important to combat unreasonable phthisiphobia. The routine disinfection of sputum, the use and disinfection of individual eating vessels and the limitation of personal contacts and of handling of objects and food to be used by others are essential in preventing the spread of infection, but involve a somewhat complicated routine.

Now, the healthy human body has in high degree the power to defend itself against the attacks of the tubercle-bacillus;

if it succeeds in so doing we find the tubercle (i. e. the local focus of infection) surrounded and separated from the rest of the body by a wall of fibrous tissue. The living tubercle-bacilli are not, however, destroyed by this process They may remain alive for years within the tubercle, and if the resistance-power of the body is lowered they multiply, escape from the tubercle by breaking the fibrous wall as it were and get into the neighbourhood or blood stream and create new foci of infection.

Now, various conditions may contribute to such a lowering of resistance: Malnutrition or undernutrition, overwork and fatigue, alcoholism, a vitiated or overheated atmosphere being among the commonest influences at work. The inhalation of silicious dust is the most powerful of all contributory factors in this disease. Knife-grinders, granite-workers may show a tuberculous death rate more than 10 times the normal.

Hence the provision of those conditions and the development of those habits, which make for the upbuilding of vital resistance are the fundamental essentials.

The Sanatorium is a training school for the development of such habits under the most favourable conditions.

Outdoor life in the day and sleeping in well ventilated porches exert an important and beneficial influence in the contest with tuberculosis.

Sunlight too is a vital factor, particularly in the non-pulmonary forms of tuberculosis, and we have already seen how sunlight helps in the development of vitamins in body tissues. The older conception as to the unique value of particular climates in the treatment of Tuberculosis has generally been abandoned. Almost any climate will serve with proper habits of life; and the migration of consumptives to distant regions should be sternly discouraged.

Adequate feeding is of course essential and in cases where undernutrition is common this may be the prime-factor in the whole situation, as occurred in Austria after the Great War. Rest, avoidance of fatigue, of over-exertion and of other devitalising influences are highly effective. Over-exertion in some way breaks down the healed tubercle and produces a spread of

the invading germ to new and enlarged foci of infection. Rest of the body as a whole is therefore the primary rule of the sanatoria and in serious cases more complete rest of the diseased lung is provided by the surgical technic of pneumothorax.

The Report of the Public Health Commisioner for India for 1936 has the following note: The most urgent need is the provision all over the Country of a chain of Tuberculosis clinics where skilled treatment and advice can be obtained from trainedstaffs of medical officers, nurses and home visitors, increase in the number of beds in hospitals and establishment of sanatoria for tuberculosis cases and the institution of Tuberculosis colonies and settlements at a later stage. No national effort on these lines and of the magnitude necessary for this Country can be succesfully undertaken without the fullest co-operation of the people, of the Provincial Governments, local authorities and voluntary agencies. The work of voluntary organisations like the Tuberculosis Association of Bengal, has been largely responsible for the development of public opinion particularly in large Cities like Calcutta, but there is need for multiplying such effort throughout the Country. Above all these schemes require financial support and the hope is expressed that the recent appeal launched by Her Excellency Lady Linlithgow on behalf of "The King-Emperor's Fund" will receive the generous support of every one interested in the welfare of India's people.

14. Bowel Diseases

(With Symptoms of Diarrhoea and Dysentery)

There are several types of diarrhoea and atleast two different types of dysentery prevalent in the Tropics; and although each affection differs much from the other regarding its causative organism the one might easily lead on to the other, or sometimes to a more dangerous affection totally different in character from the original complaint. Thus, dysentery if neglected or allowed to become chronic may lead on to very severe type of diarrhoea; or diarrhoea if allowed to run on may develop into actual cholera.

(a) Dysentery

Dysentery is a highly dangerous disease of the Tropics and sometimes occurs in severe epidemic form in barracks, in asylums and jails, and at one time used to take such a high toll of victims during War as to be considered "more destructive than shot or shell." Two distinct types of dysentery are now recognised.

(1) The Amoebic type—brought about by a minute protozoal or animal organism like the common Amoeba, (Entamoeba haemolytica) present in the bowels; and

(2) The Bacillary type—due to the presence in the bowels of a vegetable microbe or fungus, the Shiga's Bacillus.

Both varieties are recognised by the patient passing with great straining and stomach-ache stools consisting chiefly of blood and mucus (or slime)and are characterised by the presence of ulcers in the intestines. The bacillary type generally runs a very acute course and is rapidly fatal; the amoebic form, however, usualy takes on a more chronic character, but is more often followed by very dangerous consequences such as Hepatitis and the Tropical Liver-abscess, as the amoebae may find their way to the liver and cause destruction of portions of it. Tropical liver-abscess is highly fatal especially in the alcoholics and among the European residents of the Tropics taking the food and drinks of the temperate climates.

In the Tropical and Sub-tropical Zones the amoebic and the bacillary forms of dysentery occur side by side and give rise to closely similar clinical symptoms and their differentiation is difficult; and their treatment differs so completely that early and correct diagnosis is important as it may be difficult without the use of a microscope to find out the causative organism.

Infection. Persons convalescent from dysentery sometimes continue to pass for long periods the causative organisms from time to time. These may often be the sources of infection to others. Such people are known as "carriers" of the disease and their presence accounts for the frequency of the disease in crowded institutions such as jails in the Tropics and mental asylums in Sub Tropical countries. The insanitary habits of the

inmates of these asylums favour the spread of the infection.

In military camps and under war conditions the bacillary type of the disease is the prevailing form and may become epidemic.

Flies play an important part in the dissemination of dysentery owing to their habit of feeding on foecal matter and subsequently contaminating human food on which they happen to settle and pass their foeces, which has been proved to contain dysentery bacilli during epidemics. Fly-dissemination is in accordance with the seasonal distribution of the disease in India and other Tropical areas; for the cases increase during the early hot weather months when the flies are multiplying; and decrease to some extent in the hottest months, when the flies are fewer; and rise again to the maximum in the warm rainy season and autumn months, when the flies once more abound.

Similar relationship was found regarding the prevalence of dysentery in Mesopotamia also during the War.

Efficient trenching of night-soil and protection of foods from flies are, therefore, very important prophylactic measures against dysentery.

In the prevention of dysentery the following rules are to be observed:

(1) Avoid all chills and especially avoid wearing of wet clothing. Eat only well cooked and wholesome food; avoid excess in eating. Avoid alcohol in any form. Drink only wholesome water, that too after boiling. Never eat with a person suffering from the disease.

(2) Keep the house and surroundings clean, free from dust and flies, and protect all foods and drinks from contamination by flies.

(3) See that the excreta of the patient is disinfected before disposal. Disinfect the hands after handling the patient or his discharges.

(4) Disinfect properly the room occupied by the patient soon after he vacates it.

Remember that all intestinal affections are due to contamination of food and water; and if several cases do occur in a

family it is a clear indication that some defect there is in the kitchen, which should be carefully looked into.

The health of cooks should be enquired into and they must be treated at once when they show signs of the disease. The latrine should be kept clean and disinfected properly every day.

(b) Hill-diarrhoea

Hill-diarrhoea occurs at heights of 6000 feet and above in the Tropics, generally during the rainy season. It is characterised by symptoms of flatulent dyspepsia and passage in the early morning of several watery motions, which are frothy and nearly colourless (resembling white wash); they do contain foecal matter but are not offensive. The white colour is due to absence of bile in the stools from inaction of the liver.

The symptoms may be relieved by return to the plains, but if neglected may go on to the more serious condition—"Sprue."

Causation. The fact that the dyspepsia and the diarrhoea may both cease at once on the patient's return to the plains indicates that the disease is not due to any infection, but is rather a physiological weakness of the digestive organs in persons who have been enfeebled by residence in the hot plains and who are unable to withstand sudden changes of climate involved by going to the cold moist atmosphere which prevails in the Hills during the rains.

The disease may recur yearly in people who migrate annually to the Hills and produce wasting.

Hill-diarrhoea is common in the Himalayan Hill Stations of India but occurs under similar conditions elsewhere, as in the Nilgiris. It was once suggested that mica in the water of Darjeeling and other places was the irritating agent; but this has been disproved as the water on centrifugalising has been found to be absolutely free from mica or any solid particles in suspension.

The disease is, as said above, possibly due to some constitutional weakness of the digestive system brought about by the high enervating heat of the plains, bringing about a lowered resisting power of the body, as the disease affects more severely

those of intemperate habits, although the temperate are by no means exempt.

No specific organism has been found.

(c) Sprue

As mentioned already sprue is perhaps a chronic form of Hill-diarrhoea characterised by wasting of the mucous membrane of the bowels and atrophy of the liver. There is very great general wasting of the body terminating mostly in severe form of pernicious anaemia. At this stage, it is supposed that the power of assimilating vit. A and B from food is at standstill, resulting in Calcium and Phosphorus deficiency.

Chronic dysentery is also said to lead on to sprue or predispose to it.

Preventive measures. In addition to returning to the plains when once the symptoms of the disease manifest themselves, the prevention of the disease is the prevention of intestinal infection; avoidance of chills and seeking timely medical advice especially in cases of chronic diarrhoea or dysentery are essential.

15. Ptomaine Poisoning

It often happens that after a common meal or feast people who partook are attacked after a few hours with acute diarrhoea and vomiting and severe nervous collapse. It is then practically certain that the disease is due to poisons generated in the food itself by the action of certain microbes. Milk and milk puddings, or dishes of meat and fish kept exposed overnight, tinned fish and meat and tinned fruits are the foods most liable to decompose and cause poisoning.

When decomposition sets in in tinned foods the tins appear bulged from the presence of gases of decomposition formed inside. Such tins should be rejected and the contents not used as food even for animals.

Some cases of food poisoning have been due to falling in of reptiles like the skink (ಹಾವರಾಣಿ, ಅರಣೆ) in the food prepared overnight and the food being used next day.

16. Small-pox (Variola) and Cow-pox (Vaccinia)

Small-pox takes the most prominent place amongst epidemics in respect of the tenacity and malignity with which it has pursued the human race all the world over from the earliest times and the magnitude of its destructive ravages and the blindness and disfiguring it had caused before the discovery of vaccination by Jenner in 1796. According to Sir John Simon "the effects were said to be comparable to that obliteration of vegetable life which ensues when an army of locusts descending on pastures and vineyards converts into the likeness of a desert what just before was all freshness and fertility."

The disease is a highly contagious one due to a filtrable virus, causing the characteristic lesions in the skin and the mucous membranes. Various animals seem to contract the disease or a modification of it. In fact small-pox in man and cow-pox (vaccinia) in the cow show similar pathological changes; perhaps both are closely allied if not identical and there is now sufficient ground for regarding cowpox as smallpox modified by transmission through the cow.

The disease, smallpox, arises whenever the infection is carried among susceptible individuals. It was formerly a children's disease and where vaccination was employed in early childhood, smallpox became more prevalent among adults, who were never vaccinated or were vaccinated in early childhood.

One attack ordinarily protects against another; rarely 2nd and 3rd attacks have occurred in the same individual.

The source of the virus is in the lesions of the skin and mucous membrane. The virus is usually transmitted by contact with the diseased person and his discharges from the nose, mouth and skin lesions. Linen, towels, eating utensils etc. contaminated with the discharges may convey the infection. Flies and other insects may act as mechanical carriers. Airborne infection is possible from dried infected scales shed from the sores.

The incubation period varies from 10 to 12 days; the eruption or rash appears 3 or 4 days after the onset. The

disease is infectious in the pre-eruption period also and its highest infectivity is probably during the stage of vesiculation and suppuration.

Small-pox occurs in India usually during the dry months of the year from March to May.

Control. The disease can be effectively controlled by general sanitary measures, such as isolation, surveillance of contacts, and concurrent disinfection i. e. disinfection of the patient's discharges, clothing etc. when the disease is still continuing. Small-pox can be prevented by **vaccination.** The spread of small-pox in a community therefore indicates wilful neglect and ignorance.

Vaccination. Jenner in 1796 demonstrated that the inoculation of the cowpox virus in man produces an attack of cowpox (vaccinia) in him and that this attack of cowpox protects him against the human disease, smallpox.

Vaccinia in the human being is not fatal, nor is it contagious in the ordinary sense of the word. Our modern methods of Vaccination are similar to those of Jenner and produce in the vaccinated cowpox, which protects them against smallpox.

The most suitable age for vaccination is about the 6th month, as at that time there is less chance of accidental infection of the vaccination-wounds and less constitutional disturbance than in the later childhood. Moreover, certain post-vaccinal diseases like encephalitis very rarely occur in infants vaccinated under one year of age. In sick infants and in those with eczema or any kind of skin disease, and in syphilitic infants vaccination should be postponed until the child is in good health. Those who are vaccinated in infancy should be revaccinated about the 6th year, after this it is generally unnecessary to revaccinate unless there is danger of exposure to smallpox. All who are exposed should be revaccinated at once except those who have already been succesfully vaccinated within one year of the time of exposure to the infection.

The attack of smallpox occurring in a vaccinated person is usually of the mild type (variola minor or varioloid).

In a nonvaccinated person exposed to smallpox infection

the disease can be prevented if vaccination is done within 24 hours of exposure. Even if 6 to 8 days have elapsed since the exposure to infection vaccination usually "takes" and modifies the severity of the smallpox attack.

It is now an almost established fact that universal vaccination and revaccination would completely abolish small-pox from the Earth in the course of a few years. So also effective measures of public health, such as isolation, surveillance of contacts are essential in the control of the disease. By these means chance importation into a vaccinated community can also be readily controlled.

Objections have been raised against vaccination by anti-vaccinationists that it is dangerous, as in rare instances diseases like syphilis, tetanus have been inoculated with the vaccine lymph. Erysipelas and abscesses may result through lack of care on the part of the vaccinator and of the patient or the patients' guardian. But if proper precautions are taken the risk of vaccination is reduced almost to nothing by the use of the Glycerinated calf-lymph, as the glycerine is sufficient to destroy any microbes that may be present in the lymph.

Vaccine lymph is made in India in every Province and can always be obtained from any Health Official.

The period of quarantine required in cases of recovery from smallpox is 16 to 21 days after thorough disinfection.

In the Philippines the rigorous enforcement of vaccination has been followed by the almost complete elimination of small pox. Manila had annually about 6000 deaths from the disease out of a population of 250,000. After vaccination has been persistently carried on for 6 years there have been no deaths at all from smallpox; more than 10 million vaccinations were performed between 1905 and 1915 without loss of life or limb showing that vaccination in itself is practically "unattended with any risk." Yet in India remains the deplorable fact that there were 105,000 deaths for smallpox and a large percentage of blindness in 1936.

17. Leprosy

Although not an important public health problem in the temperate climates leprosy is a serious problem in the tropics

and particularly in the Orient, as there it is intimately woven into the social and economic fabric of the community. The lack of interest in and the indifference to the community health, as well as slight personal advantages of possessing loathsome ulcers to those dependent on charity or begging for their existence make eradication of the disease difficult inspite of adequate means of treatment.

Leprosy has been known even from the earliest times and the very word "leper" has passed as a synonym for an outcast who is spurned and abused by society.

The disease is due to a bacillus discovered by Hanson in 1871; it closely resembles the tubercle bacillus in several characters.

Hereditary influence. Although it was once thought that heredity played an important part in the transmission of the disease to the progeny it is now generally recognised that such transmission has not been proved to occur, and although it may be a remote possibility in rare instances it is of little practical significance in the prevention of the spread of the disease.

There is abundant evidence from the great Leper Settlement of Culion in the Philippines, where 5000 lepers live under ordinary family conditions, that inherited leprosy does not occur. Moreover in India hundreds of children who have been separated from their parents at birth have remained healthy to the 2nd generation, so that we may safely discard the paralysing theory of hereditary transmission.

The disease occurs in 2 forms:

(1) The Nervous or Anaesthetic form, in which the bacilli settle in the nerves of the limbs and cause atrophy and ulceration of the fingers, the toes and portions of the hands and feet. In the later stages of the disease the patient presents a very loathsome appearance of the face (leontiasis, the lion-face) and claw-like deformities of the hands and the feet with loss of fingers and toes which are very characteristic.

These ulcers, however, do not contain leprosy bacilli; they are only present in the nerves; and the advanced forms which we often see in beggars in the streets, though very repulsive to

sight, are, however, by no means dangerous or infectious forms of the disease, as the disease at that stage has usually died out and is not therefore infective. For this reason leprosy is said to be a "self-healing" disease.

(2) The Nodular form—In this variety the bacilli are present in enormous numbers and in groups in the skin, often on the face and head and in the nose; when the nodules break down they form sores; these sores discharge thousands of bacilli and are therefore highly infectious and spread the disease to others.

Leprosy is spread by close contact with an infectious case, the bacilli from an open sore or from the nose get on the skin of the other person and get rubbed into the scratched skin. This is especially true if the exposure to the infection is constant or long continued.

The first signs of infection are usually a smooth glistening patch on the skin especially of the arms, thighs and the back, which soon becomes anaesthetic or insensitive to touch or even prick with a needle. At this stage the disease is never infectious and is almost certainly curable. Hence if cases are recognised in the early stage much can be done to cure them and prevent them from themselves being made social outcasts and becoming a danger to others.

Later on in the course of the disease the patient is apt to get fever and rashes all over the body, and at this stage he may be very infectious through the skin or through the discharges from the nose. Hence this stage is the most dangerous as the chances of cure are much less and the chances of infecting others most marked.

It has been estimated that there are no less than 5 million cases of Leprosy in the World and that of this number approximately a million are to be found in India. Dr. Muir of the Leprosy Research at the School of Tropical Medicine. Calcutta has pointed out that ignorance, shame and fear are the reasons why leprosy is not diagnosed in the early stage—ignorance of the earliest signs and symptoms of the disease, shame lest others should know, and fear of social ostracism and loss of employment.

Fortunately one important feature of leprosy in India is that 2/3 of the cases are relatively mild and that in some of these mild cases the disease is of little clinical or public health importance.

Prophylaxis. Advanced infectious cases should be isolated as far as possible on a voluntary basis by attracting them to leper colonies and hospitals in which favourable conditions and the best treatment are provided.

If living under natural conditions any children born to leper parents should be isolated from them at birth and brought up in a separate part of the Colony, or by healthy relatives in their homes.

As many advanced and crippled cases are no longer discharging bacilli they are quite uninfective and need not be isolated. This is a very important point and very great economics have been effected in South Africa by releasing one-third of such asylum cases after negative bacteriological examination, with the further advantage that patients are now seeking admission at an earlier stage, as they realise that they will only be kept in the asylum **as long as they are infective and not necessarily for life.**

Early cases pronounced to be non-infective should be allowed to be treated as out patients in Hospital Clinics and Dispensaries under properly trained doctors. The beneficient results that have followed in these cases have attracted thousands recently by the provision of good treatment alone. Most of these cases will in course of time be cleared up and prevented from infecting others.

Hence it is advised that as soon as a case of leprosy is met with all the members of his household and other close contacts should be thoroughly examined for the early signs of the disease. This is possible only with the co-operation of the people. If this examination is repeated now and then, say, every 6 months for a period of 5 years (which corresponds to the longest incubation period of leprosy) it is hoped that atleast 60 to 70 p. c. of all new infections from each patient will be detected, and 80 p. c. of them cleared up in the early curable stage; so that if this principle is adopted in a decade or two the old advanced cases will

have died off or become uninfective, and the solution of eradicating leprosy will be in sight.

Leprosy relief work in India, as in other countries is shared by both Government as well as Private organisations. But the problem is so vast that existing organisations have so far found it impossible to produce any very striking reduction in the prevalence of the disease.

Within recent years a considerable expansion of treatment activity has resulted from the provision of leprosy clinics in different parts of the Country, but whilst present methods of treatment are of undoubted value in a proportion of cases the leprosy problem cannot be solved by treatment alone. While the segregation and isolation of all infective cases of leprosy (which probably number between 3 and 4 lakhs) is not practicable attention has to be drawn to the development of rural leprosy colonies as a hopeful line of preventive work in areas where the incidence of the disease is high.

18. Venereal Diseases

These are unfortunately one of the major problems of public health. The difficulty in controlling them is due to the fact that they are considered disgraces and are therefore kept secret by the individual. The two common forms are syphilis and gonorrhoea. The transmission of venereal disease is, as a rule, by venereal contact. Other modes of transmission are however, not uncommon, so that no one is safe. In the case of syphilis there can be no doubt that many innocent persons become infected with the disease, for it can be transmitted by contact as is shown by the infection starting on the lips and fingers of innocent people.

Syphilis

Syphilis is a specific inflammation of slow evolution caused by a Spirochaete, Treponema pallidum - and transmitted by inoculation or by inheritence. In the "acquired" form a sore—chancre, hard sore, or Hunterian chancre—develops at the seat of inoculation, (Primary stage), and is followed by constitutional

symptoms and affections of the skin and mocous membranes, (Secondary stage); at a later stage by "gummata" in the various organs, bones and elsewhere, (Tertiary stage) and sometimes by degenerative changes in the Nervous system, (Quarternary stage or parasyphilis.)

The congenital disease is characterised at an early stage by inflammation of the nasal mucous membrane, ("Snuffles") various skin-affections, enlargement of the liver and the spleen, changes in the bones and at a later stage lesions involving Teeth, Eyes, Ears and joints.

The primary and secondary lesions of acquired syphilis are very contagious.

The causative organism is the Treponema pallidum, first described by Hoffman and Schaudinn in 1905 and is found in the syphilitic lesions and in the blood in the acquired form of disease and in the organs and blood of infants with congenital disease. Syphilis has been succesfully inoculated in anthropoid apes and rabbits. It is a delicate organism living only in the presence of moisture. It has no intermediary host.

The acquired disease is usually inoculated on some part of the external genitalia during sexual intercourse, but it may be transmitted to the mouth by kissing (syphilis insontium, or syphilis of the innocent), to the skin by tattooing or vaccination, to the nipple of a wet-nurse by a syphilitic child, or to the finger of the surgeon in midwifery practice (erratic or extragenital chancre). It may also be transmitted through the shaving brush, razor, through feeding utensils and linen.

Congenital syphilis is not inherited syphilis in the strict sense of the word, but is transmitted from the mother to the foetus through the placenta. In these circumstances the mother though she is often free from signs of disease is yet syphilitic, and this is the explanation of Colles' Law, viz. that a woman who has borne a syphilitic child is herself immune to syphilis. In other words a child with congenital syphilis may infect a non-syphilitic wet-nurse but does not infect its own mother. Parents seldom transmit the disease after they have reached the tertiary stage.

Course of the disease and its effects. The incubation period of syphilis varies within wide limits but the average period is between 5 and 6 weeks. The primary sore—the hard chancre—arising at the place of inoculation is accompanied by enlargement of the neighbouring lymphatic glands (syphilitic bubo); after a few months the sore heals rarely leaving a scar. The secondary stage sets in about six weeks after the appearance of the primary sore. There are fever with malaise (vague pains in the body) and various forms of skin eruptions, some of them being exceedingly like the eruptions of small-pox; sore throat, mucous patches in the mouth, nose, vulva and anus, warty formations around the genitals and the anus, and occasionally eye troubles, deafness and affection of joints are characteristics of the secondary stage. They last about a year, but may be got rid of in a few weeks under proper treatment.

The tertiary stage usually sets in about the 3rd or 4th year of inoculation, but may do so earlier or later, and is characterised by the formation of gummata (gummy looking masses of tissue in viscera, bones and muscles), of deep ulcerations of the skin and mucous membranes especially of the nose leading to a depressed state of nose, and of arterio-sclerotic changes in the Aorta and in the blood vessels of the brain, the spinal chord, the heart muscle, liver, lungs etc.

Syphilitic affections of the heart, the larger blood vessels and of the nervous system are the most fatal. Quarternary syphilis (parasyphilis) or neuro-syphilis includes tabes dorsalis (locomotor ataxy), General paralysis of the Insane (G. P. I.) certain forms of eye paralysis and whitish patches in the mucous membrane of the mouth (leucoplakia) which frequently become cancerous.

If the patient is young and the disease is treated thoroughly from the very commencement and for a sufficient length of time after the total disappearance of the symptoms syphilis is not likely to shorten life to any appreciable extent. Treatment, however, is very commonly not of this thorough type, and temporary or permanent disablement or even death are frequently the result of cerebral haemorrhage, hemiplegia, locomotor ataxy, general paralysis and aneurysm.

Congenital Syphilis

In congenital syphilis there is no primary sore. It is rarely that a child is born with signs of syphilis; when the foetus suffers in utero it is almost always killed by the syphilitic poison, a fact which may account for the foetal deaths and the miscarriages so common in syphilitic women, though it is quite possible that the placenta oftener than the foetus is at fault.

The usual rule is that the foetus remains healthy throughout intra-uterine life and is born with the appearance of good health. After 3 or 4 weeks of birth nasal catarrh with impeded breathing (snuffles) sets in and some skin eruption and fretfulness soon follow. If the nasal affection is severe it may lead to necrosis leading to the permanent depression of the nose. The disease unless treated is at its height from the 2nd to the 4th month and the symptoms apart from snuffles are very similar to the secondary stage of the acquired form of the disease, but the general health suffers much more and death not uncommonly results from the inherited disease.

Disease of the liver in syphilitic infants is occasionally associated with gummata as in the tertiary stage of the adult, and it has been suggested that infantile cirrhosis of the liver may be a parasyphilitic affection resulting from inherited syphilis.

In the course of a year or less if the child survives the phenomena mentioned above disappear altogether, and for some years no active symptoms are present; then for a further period of years the patient is liable to suffer from lesions of various kinds and after these in their turn have died out he usually remains throughout life free from further trouble though possibly disabled in some way, such as by deafness, interstitial keratitis (ground-glass cornea), chronic synovitis of the knees and periostitis of long bones; gummata are rare in congenital syphilis.

The toll of syphilis as a factor in mortality rates can only be guessed since so large a proportion of deaths really due to syphilis are recorded as diseases of the heart, Arteries, Nervous System or as Congenital Debility. It is estimated that very

conservatively 1/5 of all deaths from organic heart disease and cerebral haemorrhage and apoplexy, and 1/3 of still-births and premature deaths of infants are primarily the result of syphilis. In fact, deaths from cardiovascular syphilis and neurosyphilis alone must greatly exceed the deaths from tuberculosis in the West. Osler many years ago made a statement that as a cause of death syphilis should be placed "at the top, an easy first among infectious diseases."

The treatment begun in the early stage is over 92 per cent effective, and the effect of treatment of late syphilis is of some doubt. For the good of the public it is urgent that all infective cases (i. e. the primary and secondary stages of the disease) should be treated and when treatment is undertaken it should be continued if it is to be effective for a period of a year or two sometimes and should include atleast 3 courses of six injections each of Neosalvarsan or its large number of substitutes. Disinfection of the common drinking cup, of combs, hair brushes, razors etc., have led to prevent the spread of the disease in barracks and camps.

So much regarding the medical procedures which form our first line of defence against venereal diseases. Behind this first line of defence is a second one, viz., legislation and social control which tends toward the limitation of opportunities from infection. This part of the work belongs to other public agencies than the Public Health Department and has to be kept separate from it. Nevertheless medical, social and educational aspects of social hygiene as a whole are all inter-related and should have their primary objective the control of organised and commercialised vice and also control of "artificial exploitation of the reproductive instinct for commercial purposes."

Educating the public in the dangers of venereal disease, and of quack treatment, their prevalence and method of spread and the physical, economic and ethical losses they entail on the individual and his posterity are very effective measures.

Gonorrhoeal Infection

The gonococcus causes 2 types of primary infection, an acute Genito-urinary-tract infection and acute purulent type of

conjunctivitis. Gonorrhoea in the male begins as a urethritis which by direct extension may involve the prostate, bladder and testes; in the female the urethra, vagina, bladder, cervix or neck of the uterus, the Fallopian tubes, ovaries and the pelvic peritoneum.

A highly infectious gonorrhoeal vulvo-vaginitis occurs in babies and young children and sometimes spreads through neglect or carelessness to other inmates in school boarding houses. The gonococcus is the essential cause of ophthalmia neonatorum (Acute gonorrhoeal conjunctivitis of the new-born) the infection of the eyes being due to contact with the infected maternal passages during birth of the child. Ophthalmia neonatorum it will be shown later, is a very common cause of blindness in children and is prevented by the well-known method of instillation of a 2 p. c. solution of silver nitrate into the eyes as soon as the infant is born (Credê's method).

The microbe of gonorrhoea is a diplococcus (Neisser's diplococcus growing in pairs) and resembles a screwhead being flattened along their opposing surfaces. It is a virulent type of microbe retaining its vitality in the urethral discharge even after escape from the body.

Secondary gonorrhoeal infection usually manifests itself in the involvement of numerous joints, fibrous tissue, muscle and tendon, but occasionally there may be endocarditis, pericarditis, pleurisy, myelitis (inflammation of the spinal chord) iritis and conjunctivitis (apart from local inoculation of the conjunctiva). The joint affection is apt to persist for months and may lead to permanent stiffness and ankylosis (with the joint bent at an angle) and permanent damage to the joint. In cases where the heart and the spinal chord are involved the outlook is very grave.

Sterility in the female is a common sequela of gonorrhoeal infection.

19. Hydrophobia and Rabies

Rabies, commonly known as canine madness, is an affection of the Central Nervous System (the Brain and the spinal chord) and occurs chiefly in the dog and its species, the jackal and the wolf.

The disease is undoubtedly a microbic affection due to a specific filtrable virus not yet isolated.

Rabies is communicable to man, and the term "hydrophobia" (which means "fear of water") is applicable only in this connection as the fear of water is not seen in the lower animals, whereas it is invariably present in human cases

Infection from animal to animal or from animal to man is conveyed usually through bites, but human beings may be infected by being licked by rabid animals on the mucous membrane of the nose, or the eyes or any portion of the abraided skin, the saliva of the rabid animal being the active infective agent

Now, the saliva has been found never to contain the infective poison earlier than 3 days before the appearance of definite symptoms of rabies in the animal

Another point to remember in this connection is that if an animal shows signs and symptoms of rabies it rarely lives more than 2 to 4 days

These two observations are very important and we may formulate the following proposition —

"If the biting animal remains alive and well for 10 days after biting a human being the saliva at the time the bite was inflicted cannot have contained the poison of rabies; and there is no danger that the person bitten will contract hydrophobia." In these cases, therefore, there is no need for the individual to undergo anti-rabic treatment.

In Europe rabies is mostly observed in the dog, but in Russia epidemics among wolves constitute a serious danger both to other animals and man. In the Tropics and in India many cases of hydrophobia are due to bites of rabid jackals. The disease can occur in all warm-blooded mammals like cattle, horses, goats, pigs and rarely in the domestic cat.

The incubation period of hydrophobia, that is the interval of time that elapses between the bite of a mad animal and the onset of earlier symptoms of the disease in the bitten person, is extremely variable. It may be as long as 8 months or [illegible] or as short as 11 days, the average being 40 days [illegible]

remembered that no symptoms of Hydrophobia manifest themselves until the poison has reached the Brain and Spinal Chord, and has set up certain changes therein. The variation in the period of incubation depends upon two factors: (1) The amount of poison injected, and (2) the situation of the bite and its nearness to the Brain. As the poison travels along the nerves the nearer the bite is to the brain, the sooner will the poison travel to the brain and consequently the shorter the incubation period. Bites on the face are therefore especially dangerous both from their nearness to the brain and bareness of the skin; moreover, wounds of the face affected by wild or rabid animals are usually deep and often multiple. Bites on the bare skin are more dangerous than bites through clothing, as in the latter case most of the saliva might be wiped off by the clothing.

During the incubation period the wound of the bite usually heals and shows no evidence of the impending disease.

Prophylactic treatment of persons bitten by a rabid or suspected animal.

A. Local treatment or treatment of the wounds. Cauterisation of the wounds with fuming nitric acid or with actual cautery is done, carbolic acid is very effective if applied within 12 to 24 hours. If the wound is deep and if there is reason to suspect that the animal was rabid the wound should be freely opened so as to bleed freely and every part of the wound should be cauterised.

Cauterisation, however, cannot be entirely depended upon to remove all chances of infection. It only destroys a considerable portion of the poison and diminishes the quantity left in the wound, thereby giving the Pasteur treatment a better chance of success.

B. Antirabic treatment,—the Pasteur treatment—or Preventive treatment of Rabies by antirabies vaccine—The question whether antirabic treatment is at all necessary or not has to be decided by the following circumstances:

1. If the animal is dead or if there was reason to suspect that the animal was mad all persons bitten and all persons licked

on definite cuts or abrasions should **atonce** undergo the Anti-rabic treatment.

2. If the attack has been unprovoked it is safe to assume that the animal was mad, and the individual or individuals should undergo the treatment atonce.

3. Under no circumstances should the animal be killed, but should be where possible tied up and watched; and if the animal remains alive for the next 10 days from the time of the bite it may be presumed, for reasons mentioned above, that the saliva could not have been infective at the time of the bite, and so the bitten individual need not undergo the antirabic treatment.

But if the suspected animal dies within 10 days it may be surmised that it was mad and the treatment should be undergone.

Of late the antirabic treatment has been made available at all Government and District Hospitals in this Presidency. The really indigent people are given the treatment free and maintenance charges of Annas six a day each or free diet for 14 days; but those who can afford to pay are being charged at only Rs. 6 for a course of 14 days' treatment. People bitten by rabid animals or by animals suspected to be rabid are advised to go atonce to the nearest Hospital or Dispensary for advice and treatment.

The object of Pasteur treatment is to confer immunity on the person bitten and consists of inoculation of the antirabic vaccine every day for 14 days. Full 14 days' treatment is required before full protection is secured.

Rabies in the Dog

Two forms of rabies are recognised, the dumb or paralytic form and the Furious form; and the symptoms of both forms, however, may be mixed up in the same case.

It is interesting to note that the signs of rabies vary with the kind of dog. Thus in pariah dogs, stray dogs and puppies furious symptoms are much more common, and human beings are often bitten by dogs of this kind. On the other hand well-bred full-grown dogs practically never bite human beings, in

fact, in the early stages of the disease they often exhibit an increased affection towards their masters or keepers. It is possible therefore, that an owner may fall into the fatal error if he should wait for the development in his dog of all the classical symptoms of rabies before he considers his dog really mad.

The bark of a mad dog is at first shriller and high pitched but later when paralysis of the throat supervenes the bark may become hoarse and muffled. The animal is restless, aimlessly wanders about or may even hide itself in dark corners; snaps at imaginary objects and may have a tendency to eat its own filth. Often it might bite the chain or the post itself to which it is tied. Such signs especially in a well bred and tied up animal is more or less indicative of madness. Later on, when paralysis of the limbs and the jaw and the throat supervene there will be dribbling of saliva and a staggering gait, and convulsions generally precede the end.

The supposed "fear of water" on the part of a rabid dog is only a myth and does not occur at all in rabid dogs, but occurs as we said, only in man affected by the disease. Hence the inference that the dog could not have been mad because it was able to drink water is not justifiable.

The incubation period of rabies in the dog varies from 16 days to 90 days; and in the majority of cases symptoms appear between the 25th and 55th day after the bite. This is the reason why it is advised that a dog which has been bitten by a rabid animal should be segregated for at least 3 months and kept under careful observation for another 3 months.

Diagnosis of Rabies. The short duration of the disease (2 to 4 days) changes in the disposition of the dog, the unprovoked fury and attack, the nature of the bark, the paralysis of the throat and the limbs and the invariable termination of the disease in death are all helpful in deciding the question of rabies. To confirm the diagnosis a microscopic examination of the brain of the animal is necessary. The presence of what are called "Negri" bodies in the brain is positive proof of Rabies; but the absence of negri bodies does not however prove the opposite.

Measures to be adopted towards animals bitten by a rabid animal: (1) When the attacking animal develops symptoms of rabies and either dies or is killed all the animals it has bitten must be treated on the assumption that they are liable to develop rabies within 3 months and even possibly within 6 months. They must, therefore, be carefully segregated for 3 months at least and watched for the next 3 months. (This is the Rule under the Quarantine Regulations in England). During this period the bitten animals should be treated by preventive inoculations preferably in a veterinary hospital.

If the bitten animals are not valuable and especially if there are children in the house it is better not to run any risk but destroy all the animals bitten.

But every dog bitten by a rabid animal does not necessarily develop rabies. Hence in the case of a valuable dog the owner might perhaps decide to run the risk of keeping it alive, and if he does, it must be said that he does so at his own risk, as the animal might at any time within the next 6 months develop rabies and be a source of danger to other animals and human beings.

In this connection it is important to remember that it is useless to tie up a suspected animal unless it is carefully watched and other animals and children prevented from approaching it.

Measures which merely prevent the biting of human beings though of great importance have no effect in controlling the spread of the disease. It is said control of the disease among dogs in a country can be had by constant muzzling of all dogs for 2 years and by placing a six months' Quarantine period on all important dogs. Another method advised is "**animal licensing**" and tagging of all dogs, with simultaneous immunisation against rabies. All unlicensed dogs can then be impounded and the unclaimed ones after a reasonable period be destroyed.

20. Tetanus

This is a specific disease caused by the Tetanus bacillus, discovered by Kitasato. It produces a toxin—Tetanotoxin. It is short, rodshaped and develops a spore at one end giving it the shape of a drum-stick; the rods in culture may come to join on

ends to produce a chain. The bacillus lives in earth, from which horses get inoculated about the hoofs; escaping from the horse it is found in stable-manure, road-earth and garden mould; and form these sources it is inoculated into man through open wounds. (See pp. 346 and 350). The disease formerly prevailed among the wounded in war from contact of wounds with earth, and often in the days before Antiseptic Surgery spread as an epidemic among the wounded and after surgical operations. A virulent from often infected the newborn infant in the Tropics from introduction of dirt on to the raw cut-end of the umbilical cord, or infected the puerperal woman from dirty handling of the genitalia during or soon after delivery. Tetanus often results through catgut and horse hair used in surgical operations.

The first sign of the disease is stiffness of the muscles of the neck and jaw, and the patient is unable to open his mouth wide (trismus or lockjaw); next the voluntary muscles of the limbs are thrown from time to time into a state of intense spasm; while in the intervals the muscles remain in a condition of undue contraction or tonic spasm. Death is almost certain to occur inspite of treatment when once the symptoms have set in, and is due to suffocation from spasm of the Respiratory muscles.

Preventive measures consist in the antiseptic treatment of all accidental wounds contaminated with earth or dirt of any sort and prophylactic inoculation of Anti-Tetanus Serum soon after receipt of the injury. All road-injuries should recieve this treatment without exception. Conduction of cases of labour by properly trained midwives should abolish the disease among puerperal women and the newborn.

21. Cancer

The cancer problem universally presents itself to the Physician as a most confusing and perhaps most difficult task. The diagnosis, if it is made in time to be of any value is difficult and the physician may not have the necessary apparatus for pathological examination or diagnostic procedures like the X-ray apparatus. Supposing a correct diagnosis is made the next question is that of treatment, which is equally difficult and even

if medical agreement is reached regarding this the means may not be available. Next, the treatment may be unsuccessful and the physician has to conduct his patient through a long painful and hopeless illness with the stigma of failure always before him.

Cancer is in its early stages a local disease and a cure can be obtained if properly treated at this stage. Our present hope for success then lies in the early diagnosis. Perhaps it is true that a special training and a large experience may be necessary for the recognition of milder or border-line conditions, but the majority of lesions require no such experience.

Cancer is a form of new-growth (neoplasm) without any physiological function, but having a tendency to assume "malignancy," that is, to steadily enlarge in all directions (without any assignable cause such as infection), to infiltrate the tissues around and become adherent to them; there is always enlargement of the neighbouring lymphatic glands; and if excised it will recur and becomes easily generalised or scattered in the body as a whole (metastasis). In the early stage cancer is not painful but becomes painful later on and is then associated with general enfeeblement of the sufferer, known as cancer-intoxication or cachexia. The condition is invariably fatal when allowed to go to the last stage.

Cancer is a disease of advanced age, generally occurring after middle age. Various theories have been put forward but most of them have no practical significance but are only of academic interest and they do not sufficiently explain the whole picture. On the other hand the theory that "trauma" or injury and chronic irritation play a major part in the causation of cancer is not only more tenable but has a tremendous practical importance. What the actual relation between chronic irritation and tumour-formation is we do not know, but there is overwhelming evidence that there is such a relationship. The history of acute trauma is very common in bone tumours, tumours of the testicle and at times in breast tumours. Irritation in the form of "repeated tissue insults" is the usual story. For example: In China cancer of the scalp is common in those that shave their scalps with rough-edged razors; cancer of the pharynx is

extremely rare among Chinese women but very common among men, as the latter always eat the rice while it is very hot. In the mountain-regions of India we find cancer of the skin of the lower abdomen (Kashmiri Shepherd's Cancer) common where the Natives wear a small stove to keep themselves warm. We find that cancer of the face is much common in rural districts where exposure is prevalent. In the Australian deserts the sharp-edged sand blown by hot-winds is frequently followed by cancer of the face that it is called the Australian disease. Cancer of the lip is often the result of smoking a hot-stemmed clay-pipe; and in the Malabar Coast of India due to excessive tobacco-chewing with betel, nut and chunam. Malfitting teeth plates, jagged teeth and faulty mouth-hygiene are well known causes of cancer of the mouth. We know that cancer of the breast is rare in cases where the breasts are not covered or bound. Cancer of the cervix or neck of the uterus is usually common among women who have had several deliveries. Cancer of the gall-bladder or kidney-pelvis is usually the result of stones in them. Cancer of the stomach is common in that part where the trauma or irritation is the greatest. Cancer occurs in burn-scars, follows X-ray-irritation and so on. And we have already seen that cancer of the lung is often due to inhaling tarry fumes from tar-macadamised road surfaces, so also cancer of the chimney—sweep and tar-cancer of the animals.

Incidence of cancer in India. Until recently the general impression in India has been that cancer claims a much smaller proportion of deaths in this Country than in Europe and America, perhaps because medical and public health reports generally make little mention of this disease. In order to obtain more accurate information an enquiry was started since 1932 under the auspices of the Indian Research Fund Association by an examination of the records of the larger Teaching Hospitals in India. The enquiry which extended to every Province including Burma revealed that the age of maximum incidence of cancer in India was atleast 10 years earlier than in Western Countries and Japan, and in the case of the female generative organs earlier by 15 to 20 years.

Cancer of the mouth is more common among males than among females, and among Muslims than among Hindus. Another interesting feature is that this form of cancer has its lowest incidence in the Punjab where the habit of chewing pan is not so common as in other parts of India. The incidence of the disease increases as one goes Eastwards and Southwards. As a result of this enquiry, two facts stand out prominently: One is that the treatment of the disease in accessible sites gives satisfactory results if a diagnosis is made **early**. The other is that few cases consult a doctor at an early stage of the disease.

Though no definite campaign has so far been planned Radium is available in four or five institutions, including the Lady Hardinge Medical College, New Delhi, the Radium Institute Patna, Bihar, the Chittaranjan Seva Sadan and the Bengal Cancer Institute, Calcutta and the Barnard Radiological Institute, Madras.

Is cancer hereditary? We are often asked by cancer family—will the disease be transmitted to the next generation and will anyone in the family catch the disease? There has never been a case recorded where the disease has been transmitted from one person to another, even among doctors and nurses working continuously with the disease. One investigator finds the incidence of cancer greater in the families of cancer patients than in those of non-cancerous patients. In mice there is an apparent transmission of tendency to tumour formation from one generation to another. But there is no conclusive evidence to make us feel at all certain that human cancer is in any way hereditary.

22. High Blood Pressure

Blood pressure beyond the normal limits is high blood pressure, also known as hypertension, hyperpiesis etc., but the exact level that the pressure must reach before it can be regarded as abnormal is not a matter of full agreement among physicians; most observers, however, accept a Systolic pressure above 155 m. m. Hg. and a Diastolic one above 95 m. m. Hg. as indicating a high blood pressure.

It is important to point out that blood pressure is not a constant measurement but one subject to variations in different individuals and marked fluctuations from moment to moment in the same individual. When physicians take the blood pressure certain precautions are usually observed before the final reading is fixed. The patient is made to have complete rest for atleast 15 minutes before the pressure is measured; he should be mentally composed since emotional excitement elevates the pressure immediately. Infact, the final estimate as to the the actual level of the pressure is not made at the first visit but only after mutual confidence has been established between the patient and the doctor. We know personally several patients with normal pressure who have been told that hypertension was present merely because the pressure was determined immediately after they had entered the doctor's office for the first time and were emotionally excited. Because of these facts it is generally considered well to take the blood pressure several times during the examination and atleast once just before the patient is ready to depart when the excitement has subsided.

The blood pressure varies considerably in health as well as in disease. In a healthy young adult male, a Systolic pressure of 110 to 135 m. m. and a Diastolic pressure of 80 to 90 m. m. as registered in the brachial artery (artery of the upper arm) may be regarded as normal, but even under a perfect variety of conditions such as rest, exercise, emotion and the like the range may be as wide as 90 to 145 m. m. in the systolic and 60 to 115 in the diastolic pressures. The blood pressure tends to be slightly less in women than in men and to be less in the young than in the old.

An abnormally high blood pressure may be met with in chronic Bright's disease (disease of the kidneys) and arteriosclerosis (thickening and hardening of the arteries with contraction of their lumen and loss of elasticity, the condition is known as pipe-stem arteries). The latter is the result of **"wear and tear of life"**; and the constant high mental tension at which many business men and professional men live must be regarded as a potent factor in promoting arterial degeneration. High tension

may be the result of an inherited tendency or of Bright's disease itself, of alcohol and tobacco habits, gout, excess in eating and drinking with lack of exercise, constipation especially chronic, with its effects of intestinal stasis and auto-intoxications, and many a time laborious occupations. Inflammation of the arterial wall accompanying enteric, syphilis and tuberculosis may pass on to fibrosis of the arteries and consequent rise in the blood pressure.

The modern urban life in which after a day of hard toil comes a night of gaiety rather than rest in which stimulation and excitement take the place of sleep suggests an important cause. In fact people living "at high speed through social excesses" are most liable.

The prevention of high blood pressure requires moderation in all things. This particularly applies to children of parents suffering from high blood pressure or any cardiovascular disease. Such children should be protected against excessive work and great ambitions. They must learn to go slowly, to take more rest and more frequent vacations, learn to play more, to get more relaxation and outdoor exercise. Inflamed teeth and tonsils, which may endanger the blood vessels should be removed. Plenty of sleep, plain digestible food in moderation, fresh air and avoidance of all excesses and excitement will start the child on the right way. Long established habits of faulty hygiene should be corrected; long hours at the desk, hurried meals rushing for trains, strenuous work and insufficient rest wear out the human body.

Symptoms of high blood pressure. Headache often described as an ache in the back of the neck, specially prone to occur in the early hours of the morning and disappearing in a few hours after leaving the bed. The headache of high blood pressure is often known among medical men as the "lead-cap headache" because of its location on the vertex or top of the head and the sense of pressure associated with it.

Dizziness is not often troublesome but may be a prominent symptom and makes physical activity impossible. Fortunately the severe form of dizziness is quite uncommon.

Pain at the region of the chest of a dull constant character.

Nervous system. In many patients the manifestations of disturbances in the nervous system outweigh all others. Among the more common are insomnia, general nervous irritability, mental depression or even melancholia, easy fatigability and repeated evidences of transient interference with the cerebral circulation, such as temporary partial paralysis, supposed to be due to spasm of the cerebral arteries followed by subsequent relaxation and restoration of the normal circulation. Sometimes anginal pains may be present due to the sclerotic condition of the coronary artery, the artery supplying blood to the heart muscle.

Prognosis. In cases of high blood pressure it is very difficult to make any satisfactory statement. In general it is correct to state that the higher the blood pressure the darker is the prognosis, but even this is a statement to which there are many exceptions. It must be kept in mind that there are many individuals who have a blood pressure well above 200 m.m. Hg. for many years without any symptoms whatsoever. We know a case where the systolic blood pressure was 212 m.m. Hg. as found out after repeated examinations. The patient came in for commutation of pension and never felt himself any signs of such a pressure. Of course he was not made medically fit as the pressure was extraordinarily high.

But a high diastotic pressure (130 to 160 m.m.) means a short duration of life, while a low diastotic pressure (90 m.m. or below) even in the presence of a high systolic level is compatible with years of comfortable life.

The duration of life after the blood pressure has reached abnormal levels depends largely upon the extent and rapidity with which arterial lesions appear in the heart, the brain and the kidneys. If arteriosclerosis develops rapidly life can be measured in terms of months and is usually terminated by cerebra haemorrhage, failure of the kidney functions (uraemic coma) or thrombotic occlusion of the coronary blood vessels.

23. Piles (Haemorrhoids)

Though not an infectious condition, it is a 'preventable' one

Piles are dilated ends of the veins of the lower rectal mucosa (internal piles), or of the veins of the skin just below the anus, (external piles). Both varieties may be present in the same patient at the same time. Piles are liable to inflammation with increase of fibrous tissue in the vein wall. Internal piles often bleed; external piles do not bleed. External piles are recognised as bluish, firm, smooth and oval, often painful swellings at the anal margin.

Internal piles are extremely common occurring about equally in males and females often between 20 and 50 years of age. A hereditary weakness of the vein-walls may be a predisposing factor. Constipation and sedentary habits, long hours of standing or sitting on a hard seat—all help the formation of piles. The venous radicles of the lower part of the rectum and the anus are without valves, and this permits the weight of the column of blood in them in the upright position to exert a considerable pressure on these radicles; constipation does similarly produce piles because of the obstruction to the venous current by foecal load in the rectum and also of the increased pressure within the veins resulting from straining at stool. Cirrhosis of the Liver (where there is fibrosis of the liver with contraction of its substance, which tends to obstruct the Portal circulation), congestion of the liver from excessive use of alcohol or frequent attacks of malarial fever; tumours of the uterus and pregnancy and cancer of the rectum,—all produce piles. From its frequent occurrence among Judicial Officers obliged in the course of their work to sit for long hours at a stretch on a seat perhaps rendered harder by constant pressure, the disease has been humourously named "The Bench Disease."

Except when inflamed or tightly gripped (strangulated) by the anus internal piles are not particularly painful; but passage of hard foeces may cause burning or smarting. When inflamed or strangulated the tissues become swollen with pain and sense of fulness in the rectum rendering sitting, walking and passage

of motions very painful, the only relief for the pain being obtained by a recumbent posture. The patient is often irritable and restless. Bleeding is one of the earliest symptoms of erosion of the pile and rupture of a blood vessel causing spirting of bright red blood on the stools. Frequent bleeding of piles gives rise to anaemia and general weakness. Such a patient with marked lowered vitality may succumb to some intercurrent affection. Piles-patients often feel comfortable over India rubber-ring-pillows or pads over seats which take the pressure off the piles. For treatment of piles and their complications medical opinion should be consulted, but as a preventive measure of the condition it is advised to prevent constipation in the first place by a suitable dietary of milk, fruits and green vegetables and pulses and a good amount of physical exercise in the open or atleast a long walk morning and evening.

24. Diabetes Mellitus and Diabetes Insipidus

Diabetes mellitus is a disorder of nutrition characterised by persistent and well marked glycosuria (presence of sugar in the urine) often accompanied by polyuria (passage of a large quantity of urine) and emaciation. In diabetes insipidus there is a large quantity of urine passed but the urine does not contain sugar; hence the name "insipidus" and there is emaciation also.

Aetiology. Diabetes (also known as the "gout of the carbohydrate eater") may occur at any age, but is especially common between the ages of 40 and 60. It is very rare below the age of 40; we have seen, however, two instances of diabetes in the young, one a boy of 7 and the other of 11. The condition was detected by a routine examination of the urine, both the patients having lost their weight to a considerable extent without any apparent cause and symptoms of fever or cough.

Diabetes is more common among males than among females. There is sometimes a hereditary or family tendency. The rich suffer more than the poor and the special liability of the Jewish race is well known. Other favouring conditions are obesity, gout, excess of food and drink, a sedentary life, city life, hard brain work, mental anxiety, lesions of the nervous system,

mental shock with or without injury to the head, abdomen or some other part of the body—may be followed by diabetes in the course of weeks or months.

Now, in normal health there is present in the blood a certain amount of sugar not exceeding .06 p.c.; when this limit is exceeded the extra sugar passes out in the urine. The generally accepted theory of diabetes is based on the teaching of Claude Bernard that the carbohydrates of food are stored up in the liver in the form of glycogen, that the latter is reconverted into sugar and discharged into the blood as required by the body cells. In diabetes therefore the excess of sugar in the blood and consequently its appearance in the urine are due to increased production of sugar by the liver or to diminished consumption by the tissues or to both these causes.

It will be shown later that in a large proportion of cases changes of some kind are found in the pancreas. When there are no gross lesions there may be microscopic changes. Complete extirpation of the pancreas in dogs is followed by diabetes. But if a portion of the pancreas remains in the body either in the original situation or after transplantation diabetes does not occur, and it has been demonstrated that the organ produces an "internal secretion" which is necessary for the assimilation of sugar. The part of the pancreas which is particularly connected with diabetes is the Islands of Langerhans, which may be looked upon as constituting a ductless gland and are the source of the internal secretion of the pancreas known as "insulin" (insula = an island). When the Islands of Langerhans are destroyed by malignant disease (like cancer or sarcoma) involving the entire pancreas or by its chronic inflammation diabetes results. Insulin, extracted from the pancreas of animals forms the present treatment of diabetes.

Diabetes generally makes its appearance gradually. The principal symptoms are increase in the quantity of urine (polyuria) and increase in the frequency of micturition, increased thirst (polydipsia), a ravenous hunger (polyphagia) and loss of flesh and strength. The skin is usually dry, constipation is the rule and is due either to restricted diet or passage of a large quantity of

fluid by the urine. In elderly people diabetes is often of a mild type and may affect the general health very little.

The urine is pale, acid and sweet-smelling, the quantity passed per day of 24 hours may be 10 to 12 pints, with a sp. gr. of 1030 to 1040 and a daily output of 15 to 20 ounces of sugar (dextrose or grape-sugar, not cane-sugar) which is present in the urine to the extent of 8 to 12 p. c. The output of sugar is of course much influenced by diet.

Test for sugar in the urine. This depends upon the power of grape-sugar to reduce certain metallic salts in an alkaline solution. Fehling's Test is the most convenient and most reliable of all tests for detecting the presence of grape-sugar in the urine. Two solutions are employed, (1) Fehling's copper sulphate solution and the other (2) Fehling's alkaline solution. Half a dram each of the two solutions are mixed together in a test-tube and boiled. The suspected urine is then added drop by drop, the mixture being raised to the boiling point after each addition. If sugar is present in any quantity a red or brick coloured precipitate of the Suboxide of copper will appear. If there is only a trace of sugar (less than 0.5 p.c.) in the urine precipitation takes place more slowly and the change in colour is olive-green instead of red.

The quantitative test or determination of the percentage of sugar is also done in a similar manner with measured quantities of urine and Fehling's solutions.

Complications. (1) Coma. This is frequent and is almost invariably fatal. The onset of coma is often rapid. There are abdominal pain with langour, constipation and perhaps vomiting. Drowsiness follows and breathing becomes very deep (Air-hunger); breath and urine may have a sweetish odour like that of apples or chloroform and is due to the presence of acetone. The drowsiness deepens into coma, and death results within one or two days.

Coma appears to be favoured by young age, by muscular fatigue, by obstinate constipation, by exposure to heat or cold, by excitement and worry, and as often happens by the sudden deprivation of carbohydrate food. The coma is due to an intoxication caused by the accumulation in the blood and tissues of acetone bodies.

(2) Tubercle of the lungs or pneumonia with gangrene of the lungs is a cause of death in a minority of cases but may not be accompanied by marked fever and cough. (3) Boils and carbuncles, (4) excessive itching at the urethral meatus (pruritus) caused by the deposit of glucose, and (5) gangrene of the limbs, especially of the lower limb is the commonest complication.

In diabetes the younger the patient the worse is the outlook as a rule; in elderly patients the disease is generally longstanding and is not easily followed by complications. Carefulness in diet and ability to select good food are important elements in judging the prognosis. If a restricted diet removes sugar from the urine completely the prognosis is good; whereas if the sugar persists, the emaciation continues and the urine contains acetone bodies, the prognosis is much more serious. The severe cases often end in coma; the mild cases tend to kill slowly by diminishing the power of resistance to diseases like Tuberculosis, Pneumonia, Influenza etc., or by causing premature senility in the arteries with such consequences as gangrene of the lower limbs, cerebral apoplexy etc. Very few cases of coma recover even under energetic treatment.

Prevention of Diabetes. Personal Hygiene should be the chief preventive of Diabetes. Every individual should avoid obesity as it is this group that is most prone to develop the disease. Moderation in diet is important; the amount of starches and sugars should be regulated. A well-balanced diet with plenty of vitamins is of utmost importance. Individuals leading sedentary lives should have mild exercise consistently; these individuals should be particularly careful to refrain from violent exercise if they are not accustomed to it ordinarily. Control of the emotions should be practised. Many individuals are habitual worriers, and frequent excitement is apt to affect the health. Each individual should endeavour to develop a philosophy of life that would enable him to keep calm under any circumstances.

A periodic medical examination after the 40th year including analysis of urine should serve to detect early the presence of disease. Individuals with a history of diabetes in their families

need to watch themselves more closely than others. The individual with diabetes should be taught how to care for himself under the guidance of the physician, and his diet should be planned, and it is necessary that he adheres to it. Particular attention should be paid to the feet in order to minimise the dangers of gangrene, cleanliness is of the utmost importance as the skin of the diabetic contains sugar and is peculiarly susceptible to pyogenic infections like boils, carbuncles, erysipelas. Whenever the diabetic falls sick he must immediately summon a medical man, have only liquid diet, take to bed, keep warm and have somebody to attend to his comforts.

Precautions to be taken by diabetic patients. On detection of the presence of sugar in the urine the patient should take great care as to suitable clothing, a healthy atmosphere and avoidance of constipation, of mental worry and excitement and of fatigue. He should keep himself at first on an ordinary diet (except that sugar is to be replaced by saccharin) so that the daily output of urine and sugar may be ascertained. The body weight should also be noted at regular intervals. Then the Carbohydrates are to be gradually withdrawn. It is safe for the patient to take fish, fowl and flesh (except liver and oysters as these are apt to contain glycogen). Eggs, butter, cheese are permissible; milk is objectionable theoretically as it contains lactose (milk sugar), but in practice a moderate quantity, even one pint daily, may sometimes be taken with advantage. Soups, Tea, Coffee, aerated waters are allowable if free from sugar. Alkaline mineral waters should be taken freely, and if acetone bodies are suspected or are present in the urine one or two drams of sodium bicarbonate may be taken daily. Green vegetables, leafy vegetables, tomatoes, radishes, peas, beans may be taken. Sweet fruits, beer, potatoes, turnips and all farinaceous foods must be avoided. Bread should be brown bread or specially made bread from casein, egg, fats, gluten, almonds, cocoanuts etc.

After the urine has been sometime free from sugar, carbohydrates are to be gradually restored to the dietary beginning with one potato daily, then another, then one or two ounces of

bread or cooked rice or oatmeal, and if sugar reappears it is advised to go back to the strict diet and begin again.

When he has nearly regained his normal weight an effort should be made to reduce the intake of protein and especially of meat, so as to lessen the risk of acidosis and to lessen the strain on the organs (the kidneys especially) concerned with the excretion of protein waste.

If after a month's trial of a strict diet the urine still contains **much** sugar it is well under medical advice to give a certain amount of carbohydrate, not only because it is agreeable to the patient but also because it tends to avert acidosis, the risk of which attends upon such a case; a little bread, a few potatoes or rice and about one or even two pints of milk may be allowed daily. In fact when coma threatens physicians usually recommend reversion to a carbohydrate diet and use of alkaline drinks.

For itching of the genitals the parts should be washed everytime after urination with hot water if possible and dried.

In the selection of a dietary for diabetic patients the following list may be found useful.

1. **Allowed:** Meat of all kinds except liver, poultry and game, fish of all kinds (fresh or cured) crabs, lobsters, animal soups, beeftea and broths, eggs, cream, butter, cheese, gluten bread, soyabean bread, whole meal wheaten bread, greens, spinach, Rhubarb, turnip tops, watercress, mushrooms, amaranthus, ash-gourd, pumpkin, cucumber, lettuce, endives, tomatoes, onions, radishes and celery, bitter gourd, tender jack, snake gourd, ridge gourd, milk gourd, colocasia stem and leaves, drumsticks and plantain flower.
2. **Allowed in moderate quantity:** Turnips, peas and beans, brussel sprouts, cabbage, cauliflower, knollcolls, asparagus, vegetable marrow, chow-chow, tender bamboo, kovakai, brinjals, ladies' fingers, jellies and blancmanges and custard—all without sugar. Nuts—all nuts except chestnuts and jack

seeds. Certain pulses—soya beans, red gram (ತೊಗರಿ) Bengal gram (ಕಡಲೆ) black and green grams, cow gram (ಕರಮಣಿ) horse gram, dhal and lentils.

3. **Forbidden:** Sugar in any form, wheaten bread and ordinary biscuits, rice and other cereals, arrowroot, cornflour, sago, tapioca, macaroni, vermicelli. Bread fruit, yams, colocasia, coleus (ಕುಲುಕು) potato (ordinary and sweet) carrots, beetroot, Spanish onions, pastry and puddings, all sweet fruits whether fresh or preserved, liver, oysters and mussels.

Drinks and Beverages. Allowed—Tea, coffee and cocoa with saccharin, soda water, sherry, claret and brandy. **Forbidden**—Milk except sparingly, sweet ales, porter, stout, cider, sweet wines and rum.

25. Obesity

This is a state of the body in which there is excessive deposit of fat within the tissues. The development of obesity is one of the most common of human afflictions and one which in the light of recent knowledge is both preventable and curable in all cases. The cause of obesity is always the result of an excessive use of carbohydrates and fats much in excess of the energy requirements of the body.

Our criteria of what shall constitute normal weight are in a measure arbitrary and depend upon statistical studies of weights of healthy individuals taking them in age, sex and height groups.

There are two main types of obesity. One group embraces the vast majority of obese persons and has been attributed to "overeating"; the other group is composed of those individuals who eat normally but who become obese owing to retardation of oxidative processes usually resulting from disturbance of function of one or more endocrine glands. As will be pointed out later marked obesity develops in people suffering from hypo-pituitarism associated with genital dysfunction (as after castration for example). Hyperpituitarism, however, leads to gigantism and

acromegalia but not to obesity. (See under Endocrine disorders).

The change from a life of physical activity to one of sedentary existence without appropriate changes in the habits of eating is one of the commonest causes of obesity. The weight then gained from the storage of fat results in increased inertia (sluggishness or sloth) with decreased heat-loss, and this in turn enhances fat-storage, and thus a vicious cycle develops.

The tendency for obesity is sometimes inherited, and in those who have such predisposition its development is favoured by overeating, by want of exercise and by alcoholism. But it is by no means always due to overeating. Chlorotic girls are often stout—possibly in them the oxidation processes are sluggish from anaemia (and consequent absence of haemoglobin in the blood). Women after menopause and men after middle life often become corpulent.

Bad effects and disadvantages of obesity. Obesity is not only a "cosmetic misfortune" but a physical and *mental* handicap at any period of life. Generally speaking it may be said that there is nothing in life which is more conducive to misery and unhappiness than obesity, and the myriad frauds and fads which people embrace in order to lose weight—"to slim" in the language of the fair sex—attest to this fact. Obesity often leads to Diabetes, Fatty heart, Gall bladder disease and stone, High blood pressure and Cardio-vascular disease. The expectancy or duration of life in obese people has been shown to be definitely less than in normal people by the statistical studies of Life Insurance Companies. Apoplexy and heat-stagnation and heat-exhaustion are common causes of death in the obese.

Prevention of Obesity. Prevention depends upon the education by the physician of the families and upon the control of diet before the condition is established. Among women the fashion "of slimming" plays an important part in the regulation of the body weight.

Since obesity results from over-nutrition the treatment is essentially one of dietary regulation. In the presence of mild obesity resulting from ingestion of amounts of food greater than are theoretically required, mere limitation of sugar, bread, potato

and other starchy foods, pastry, cream and butter in the diet may bring about the desired results. It is advisable to have these patients keep a list of all the food they eat each day inclusive of the size of the portions. Using these diet-lists as a working basis it is easy to readjust the amounts and types of food to be taken for further reduction.

Patients following this scheme quickly gain a knowledge of the food-limitations which must in their particular case be adhered to in order that they may maintain their normal weight.

As an adjunct to dietary treatment various forms of physiotherapy (exercises and massage) may have some value, but it must be said that in the absence of adequate diet regulation these measures in themselves are not only useless but perhaps dangerous too.

26. The Endocrine Disorders

In the extraordinarily rapid advances made by Science within the last few decades no section has attracted keener interest of Biochemists than that which deals with the endocrine organs, also called "ductless glands" or organs of internal secretions, and their chemical messengers, the Hormones (or internal secretions) by means of which they stimulate or control the activities of cells in the various parts of the body; and the conception has already gained ground that many bodily and a few mental disorders are fundamentally due to excessive or insufficient activity of one or other of these organs, and could be corrected either by surgical methods on the one hand, or by the therapeutic use of appropriate extracts to make good existing deficiencies on the other. Hence one cannot be surprised to find that so much of experimentation has been carried on in this line but with varying results.

Nevertheless, a character, the body structure or mental acuity may be changed by the administration of hormonal extracts, and it is possible we may soon be able to shape the future race into one of even-tempered, happy, energetic and of pleasing appearance and free from diseases like high blood pressure, diabetes, cancer, obesity etc.

The ductless glands play an important role in health and in disease, because of the influence which they exert on the development and metabolism of the body. They have a considerable degree of relationship with one another, so much so that if one is diseased disturbances may ensue in one or more of the others. For example, when the thyroid produces too much secretion, glycosuria (presence of sugar in the urine) may occur owing apparently to disturbance to the function of the pancreas, and the thymus may undergo hypertrophy.

In addition to the true ductless glands (like the thyroid, the thymus, the adrenals, the pituitary and the pineal glands which are devoid of any external secretion) the pancreas, the liver, the testes and the ovaries (which have also the characteristic external secretion of their own as the pancreatic juice, the bile, the semen and the ovarian secretion respectively) also do yield important hormones having the power to stimulate the activities of any organ or tissue.

1. **The Adrenals:** (or suprarenals, so called as they are situated on the kidneys one on each). The adrenals discharge a hormone—adrenalin—into the circulation, which has the power to stimulate the contractions of muscular organs like the Heart and the blood vessels and the uterus. Disease of the adrenals is accompanied by extreme weakness and lassitude, wasting and bronzing of the skin—the condition is called **Addison's Disease** (morbus Addisoni) and has a fatal termination.

Overactivity of the adrenals on the other hand produces "**virilism**"—a condition characterised by precocious sex-development and sex-function with excessive growth of facial and bodily hair.

2. **The Thyroid glands.** (Thyroid means Shield-like). They are situated one on either side of the wind pipe. While not quite essential to life the thyroid hormone exerts a profound influence in the general body-economy.

Extirpation of the thyroid-analogue in the tadpoles has resulted in their failure to properly grow into frogs; but when a small piece of thyroid tissue is grafted under the skin of such a tadpole it will resume its development in a normal manner. In

man, however, 20 years must elapse before the body-structure can be said to be completed; and thyroid dysfunction during this period if sufficiently severe or prolonged is almost certain to interfere with the normal development of the individual. Moreover the thyroid continues among the most important regulators of metabolism **throughout life.**

Underactivity of the thyroid (Thyroid insufficiency) existing from birth is the cause of "**cretinism**" (where the patient retains the size, appearance and mental outlook of a rather stupid child) and **deaf-mutism** and other forms of defectiveness in the development of both body and mind.

The number of defective offspring of goitrous (goitre is "Derbyshire Neck") and hypothyroid women is, however, startlingly high, and if every physician should look upon every goitrous father or mother as the possible precursor of defective offspring and treat him or her accordingly much could be done toward the eradication of mental and physical defectiveness due to congenital hypothyroidism. Fortunately most of the hypothyroid women are sterile. Evidently the active thyroid hormone concerned with the development of the foetus is wanting in them and the sterility should be considered a natural protective measure to prevent the woman from handing the condition to her offspring.

Iodised salt, Iodine in drinking water, a few drops of the saturated solution of sodium Iodide given routinely has almost eradicated endemic goitre with its inherent dangers to future generations. It is highly remarkable that in the prehistoric era burnt sponges and seaweed-ashes were used by the Chinese in goitre, since these substances contain Iodine. In the Roman era Caesar speaks of big-neck among the Gauls; and the Romans recognised that slaves with bulging eyes (exophthalmic goitre) fatigued readily.

Acquired hypothyroidism is a condition of thyroid-underfunction, which may appear at any age in the previously normal individuals; hence in this condition there is no marked retardation of growth, bodily or mental, but only a condition of myxoedema, which indicates that the metabolic activities are

rather slow. In myxoedema an albuminous fluid accumulates in the subcutaneous tissues and gives the patient a waxy puffy appearance, the skin is dry and thickened, the hair easily pulled out, pulse slow and the brain function sluggish.

Over-activity of the thyroid gives rise to diffuse, toxic goitre (**Exophthalmic goitre, Grave's disease or Basedow's disease**) characterised by a bulging appearance of the eyes, a rapid pulse, tremors and general muscular weakness.

Both myxoedema and toxic goitres yield to Iodine treatment outlined above. Thyroid extract given internally reduces myxoedema and excessive fat of obesity.

3. **The Parathyroids.** These are two pairs of small very vascular bodies about the size of lentils, each pair situated behind each thyroid gland and intimately connected with it and each other. They are intimately associated with Ca and P metabolism; and extirpation of the glands results in a sharp fall of the Ca in the blood serum with tetanic convulsions and death; and the administration of the parathyroid hormone raises the serum Ca. In large doses parathyroid hormone will withdraw Ca from its storehouse in the bones and excrete it in the urine. Hence it is presumed that the function of the parathyroid hormone is to mobilise Ca into the blood stream where it is utilised by vit. D and perhaps hormones of the other ductless glands.

4. **The Pancreas** has two secretions,—(1) an external secretion—produced by the secreting cells of the pancreas and which reaches the duodenum and acts as a powerful digestive juice; and (2) the internal secretion—pancreatic hormone or insulin—produced by what are known as the "Islands of Langerhans" and is concerned with the assimilation of Carbohydrates. It is now generally agreed that the fundamental defect in **Diabetes** is a deficiency in the secretion of insulin by the pancreas and that in consequence the capacity of the body to oxidise Carbohydrates is severely impaired; the capacity of the body to store sugar in the form of glycogen in the liver is also affected; as a result of the latter the concentration of sugar in the blood rises abnormally high and large quantities of sugar may be passed in the urine.

The body being thus unable to derive energy from Carbohydrate metabolism, the blood becomes laden with products of fat-metabolism—acetone bodies—which are the active cause of Diabetic Coma preceding death.

The administration of insulin causes a prompt fall in the blood sugar, some sugar being oxidised and some deposited in the liver as glycogen; the acetone bodies also disappear from the blood and urine, and the glycosuria (sugar in the urine) is abolished.

5. **The Pituitary Body.** This is a small gland about 6 or 8 grs. in weight attached to the base of the mid-brain occupying the Sella Tursica (the Turkish-saddle-like fossa or depression) of the sphenoid bone. It consists of an anterior lobe and a posterior lobe.

The anterior lobe regulates the growth of the skeleton and sexual development; the posterior lobe influences Carbohydrate and fat metabolism, promotes contraction of muscular tissue as of the heart, the uterus and the intestines, and stimulates the activity of the kidneys and the breasts.

Gigantism and Acromegaly* are supposed to be due to excessive function of the anterior lobe, the former originating in the developmental period, the latter in adult life. Defective function of the anterior lobe on the other hand, leads to sexual and skeletal infantilism with obesity if the defect dates from childhood, and to atrophy of the genitals and loss of sexual characters and obesity if it begins in adult life.

6. **The Testes** are glands secreting both an external secretion (seminal fluid) and internal hormone (the testicular hormone). Since the time of Brown Sequard senility in the male has been regarded as due to failing secretion of the testicular hormone. Many reports of restored health and muscular as well as sexual vigour with possibly prolongation of life after implant-

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**Acromegaly is a chronic disease characterised by enlargement of the bones especially of the hands, feet and face. Often there is bowing of the spine in extreme cases suggesting a "reversion to the Gorilla type."*

ation or more rarely injection of testicular material are to be found in medical literature. In the hands of Voronoff who has made repeated transplantations of testicles from the higher apes into man both in treatment of senility and for the benefit of castrated individuals, these experiments have attained a certain notoriety. All workers in this field have been too prone to record only their successes and to pass over the number and the fate of their failures in silence; this reproach together with a not unnatural feeling of repugnance will probably retard the employment of such measures until the experimental basis is more secure.

(Steinach believing that the testicular hormone is derived from Leydig's interstitial cells had tied legatures between the testis and the epididymis and recorded striking increase in weight, improvement in vigour and disappearance of impotence both in animals and man. It is customary to say in describing such operations that suggestion is guarded against, but it is by no means easy to see how this desirable consummation is achieved.

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From the study of the endocrine diseases we naturally pass on to the influence of emotions on bodily health.

VI. Mental Emotions in Relation to Bodily Health and Vigour

Our thoughts, various mental states and emotions do all produce their effects on the physical body. Suppose a telegram brings sudden and unhappy news, you grow pale, you tremble and you might even fall into a fit; or, a friend says something to you at the dinner table, something which is unpleasant, you feel hurt by it, you have been enjoying your dinner, but from that moment you have no appetite for food. Again, a sudden emergency arises, you stand trembling and weak with fear and powerless to move; or you are for a moment dominated by a fit of anger and for a few hours afterwards you complain of violent headache—all this because your thought and emotions have

produced their effects on your system. For the same reason people given greatly to mental worry cannot be strong and vigorous or active.

We have several well authenticated cases of the relation of the mind to body-functions like the following:

A mother has been dominated for a few moments by a sudden and intense passion of anger and the child at the breast has died within the next hour; so much poisoned became her milk under the influence of anger. In other cases similar fits of anger on the part of the mother have caused severe illness and convulsions in the child at the breast.

The following experiment has been tried a number of times by a well known scientist. Several men have been put into a heated room. Each man has been dominated for a moment by a particular passion of some kind, one by an intense passion of anger and others by different other passions. A drop of perspiration from the body of each of these men was taken and by careful analysis it was found possible to determine the nature of the particular passion by which each has been dominated.

Practically the same results were revealed by the analysis of the saliva of these men.

It is well known that sudden and violent emotions have not only weakened the heart but have caused death or insanity.

It has been discovered by scientists that there is a chemical difference between that sudden cold sweat of a person under a deep sense of guilt and the ordinary perspiration, and the state of the mind can sometimes be determined by chemical analysis of the perspiration of a criminal. It is well known that fear has killed thousands, while courage is a great invigorator, Small mental emotion often causes giddiness and vomiting; extreme anger or fright may produce jaundice. A violent paroxysm of rage has caused apoplexy and death. And indeed in more than one instance a single night of mental agony has wrecked lives. Grief, long standing jealousy, constant worry and corroding anxiety have in several instances developed insanity. Sick thoughts and discordant moods are the natural atmosphere of disease, and crime is engendered and thrives in the miasma of the mind.

That mental worry causes indigestion, ulcer of the stomach and certain other illnesses has been proved at the Tavistock Clinic and the Royal Free Hospital, London. Infact it is said that ulcer of the stomach is in origin a disturbance of the mind and deserves no more and no less attention than does dyspepsia, which is also in many cases an imaginary malady (Maladie imaginaire).

In regard to the mode of operation of these mental states, emotions and passions physiologists say it is due to the activities of the endocrine organs, which, as we have seen act not singly but more or less in co-ordination with one another.

Auto-Suggestion

A physician goes to see a patient but may not give the patient any medicine at the first visit, yet the patient says that he feels better after the doctor's visit—why? Because the physician has carried with him the spirit of health, so to say; he has carried brightness of tone and disposition, he has carried hope into the sick chamber and has left it there. In fact, the very hope and good cheer the physician had carried with him has had a subtle and powerful influence on the patient's mind; and this mental state imparted by the physician has in its turn its effects upon the patient's body, and so through the instrumentality of the mental suggestion healing proceeds.

"Know, then, whatever cheerful and serene
Supports the mind, supports the body too.
Hence, the most vital movement mortals feel,
Is hope, the balm and life-blood of the soul."

We sometimes hear a person in weak health saying to another "I always feel better when you come." There is a deep scientific reason underlying this statement, for "the tongue of the wise is health."

People there are who are afraid of a simple draft and overcover themselves to avoid catching a cold. There is nothing in a draft to cause trouble or bring on a cold or perhaps any illness, it is only a little purifying current of God's pure air. The draft can affect one only if he is inclined to imagine it is going to

affect him. For example, suppose two persons are sitting in the same draft, the one is injuriously affected by it, the other experiences not even an inconvenience, but rather enjoys it. The one is a creature of circumstances, he fears the draft, cringes before it and continually thinks of the harm it is doing him; in other words he opens up an avenue for the draft to enter and take hold of him and so it, harmless and beneficient in itself, brings to him exactly what he has allowed it or empowered it to bring. The other recognises himself as the master over, and not the creature of, circumstances, he is not concerned about the draft, he puts himself into harmony with it, makes himself positive to it and instead of experiencing any discomfort he enjoys it, and in addition to its doing him a service of bringing the pure fresh air from without to him, it does him the additional service of hardening him even more to any future conditions of a like nature.

The best way to disarm a draft of the bad effects it might bring one is first to bring about a pure and healthy set of conditions within, then to change one's mental attitude toward it; recognise the fact that the draft has only the power you invest it with. Thus you will put yourself into harmony with it and will no longer sit in fear of it. Next, sit in a draft a few times and get hardened to it as any one by going judiciously can readily do.

But suppose you are in delicate health or especially subject to drafts. Then be simply a little judicious at first, do not seek the strongest that can be found, especially if you do not as yet in your own mind feel equal to it; for if you do not, it signifies that you still fear it. That supreme regulator of all life, good common sense, must be used here as elsewhere.

"The whole of human life" says Waldo Trine "is cause and effect. There is no such thing in it as chance, nor is there even in all the wide universe. Are we not satisfied with whatever comes into our lives? The thing to do, then, is not to spend time in railing against the imaginary something we create and call "fate," but to look to the within, and change the causes at work there in order that things of a different nature may come, for there will come exactly what we cause to come.

"And then whatever does come to one depends for its effects entirely upon his mental attitude towards it. Does this or that occurrence or condition cause you annoyance? Very well, it causes you annoyance and so disturbs your peace because **you allow it to.**

"You are born to have absolute control over your own dominion, but if you voluntarily hand over this power, even it be for a little while, to some one or to something else, then you of course become the creature, the one controlled."

There is probably no agent that brings us more undesirable conditions than **fear.** We should live in fear of nothing. An old French proverb says:

"Some of your grief you have cured,
And the sharpest you still have survived,
But what torments of pain you endured
From evils that never arrived!"

In other words most of our sharpest griefs are of our own making, of our own imagination.

"Where are you going?" asked an Eastern Pilgrim on meeting the Plague one day. "I am going to Bagdad to kill 5000 people" was the reply. A few days later the same pilgrim met the Plague returning; "you told me you were going to Bagdad to kill 5000 people" said he "but instead, you killed 50,000." "No" said the Plague "I killed only 5000 as I told you I would, the others died of **fright.**"

Fear can paralyse any muscle in the body, fear affects the flow of the blood, like wise the normal and heathy action of all the life forces. Fear can make the body rigid, motionless and powerless to move.

Says Trine: "Children, and especially when very young, are generally speaking more sensitive to their surrounding influences than grown up people are; some are veritable little sensitive plates, registering the influences about them and embodying them as they grow."

"How careful in their prevailing mental states, then, should be those who have them in charge and especially how careful should a mother be during the time she is carrying the child,

and when every thought, every mental as well as emotional state has its direct influence upon the life of the unborn child! Let parents be careful how they hold a child, either younger or older in the thought of fear. This is many times done unwittingly on their part, through anxiety and at times through what might well be termed, **overcare**, which is fully as bad as **uudercare.**"

"We often see in a number of cases where children have been so continuously held in the thought of fear lest this or that condition come upon them, that the very things that were feared have been drawn to them, which probably otherwise never would have come at all. Many times there has been no adequate basis for the fear; in case there is a basis, then far wiser is it to take exactly the opposite attitude, so as to neutralise the force at work and then to hold the child in thought of wisdom and strength that it may be able to meet the condition and master it instead of being mastered by it."

Fear and worry, then, and all kindred mental states will bring their own peculiar type of ailment. An inordinate love of gain, a close fisted hoarding disposition will have kindred effects. Anger, jealousy, malice, continual fault-finding, lust,—each has its own peculiar corroding, weakening, tearing down effects.

"The bodies of almost untold numbers living their **one sided, unbalanced** lives" says Trine, "are evey year, through these influences, weakening and falling by the way side long before their time; poor houses! Intended to be beautiful temples brought to desolation by their ignorant, reckless, deluded tenants!"

"A study of the human body," he continues, "its structure and length of time it takes to come to maturity in comparison with the time it takes the bodies of various animals and their corresponding longevity, reveals the fact that its natural age should be nearer a 120 years than what we commonly find to-day. But think of the multitudes all about us, whose bodies are ageing, weakening, breaking, so that they have to abandon them long before they reach what ought to be a long period of strong vigorous middle life. Then, the natural length of life-time being thus shortened it comes to be what we might term a race-belief

that this shortened period is the natural period. As a consequence many, when they approach a certain age, seeing that as a rule people at this period of life begin to show signs of age, to break and go down-hill, as we say, they thinking it a matter of course and that it must be the same with them, by taking this attitude of mind many times bring upon themselves those very conditions long before it is necessary.

''Subtle and powerful are the influences of the mind in the building and rebuilding of the body. As we understand them better it may become the custom for people to look forward with pleasure to the teens of their second century.'

Auto-suggestion and Health

''Would you remain always young,'' asks Waldo Trine, 'and would you carry all the joyousness and buoyancy of youth into your mature years? Then have care concerning but one thing—how you live in your thought-world.' This will determine all. It was the inspired one, Goutama Budha, who said 'The mind is everything and what you think you become.' The same thing had Ruskin in mind when he said—'make yourself nests of pleasant thoughts. None of us as yet know, for none of us have been taught in early youth, what fairy palaces we may build of beautiful thoughts—**proof against all adversity.**'

''And would you have in your body all the elasticity, all the strength, all the beauty of your younger years? Then live these in your mind, making no room for unclean thought and you will externalise them in your body. In the degree that you keep young in thought will you remain young in body; and you will find that your body in turn aid your mind, for body helps mind just as mind builds body.

''Your particular kind of thought connects you with a similar order of thought from without; if it is bright, hopeful, cheerful, you connect yourself with a current of thought of this nature; if it is sad, fearing, despondent, then this is the order of thought you connect yourself with.

''If the latter is the order of your thought then perhaps unconsciously and by degrees you have been connecting yourself

with it. You need to go back and pick up again a part of your child-nature, with its careless (= without cares or without worry) and cheerful type of thought.

"The minds of the group of children at play are unconsciously concentrated in drawing to their bodies a current of playful thought. Place a child by itself, deprive it of its companions and soon it will mope (= be depressed in spirit) and become slow of movement. It is cut off from that peculiar thought-current and is literally "out of its element."

"You need to bring again this current of playful thought to you which has gradually been turned off. You are too serious or too sad or absorbed in the serious affairs of life. You can be playful and cheerful without being puerile (= boyish or childish) or silly. You can carry on business all the better for being in the playful mood when your mind is off your business. There is nothing but ill resulting from the permanent mood of sadness and seriousness—the mood which by many so long maintained makes it actually difficult for them to smile at all.

"At 18 or 20 you commenced growing out of the more playful tendency of early youth; you took hold of the more serious side of life. You went into some business, you became more or less involved in its cares, perplexities and responsibilities. Or, as man or woman you entered on some phase of life involving care and trouble. Or, you became absorbed in some game of business which, as you followed it, left no time for play. Then as you associated with older people you absorbed their old ideas, their mechanical methods of thinking, their acceptance of errors without question or thought. In all this you opened your mind to a heavy care-laden current of thought; into this you glided unconsciously, that thought is materialised in your blood and flesh. The seen of your body is a deposit or crystallisation of the unseen element ever flowing to your body from your mind. Years pass on and you find that your movements are stiff and cumbrous—that you can with difficulty climb a tree as at 14. Your mind has all this time been sending to your body those heavy, inelastic elements making what now it is ....

"Your change for the better must be gradual and can only

be accomplished by bringing the thought current of an all-round symmetrical strength to bear on it, by diverting your mind from the many unhealthy thoughts, which habitually have been flowing into it without your knowing it, to healthier ones.

"Full, rich and abounding health is the normal and the natural condition of life. Anything else is an abnormal condition, and abnormal conditions, as a rule come through perversions. God never created sickness, suffering and disease, they are man's own creations, they come through his violating the Laws under which he lives. So used are we to seeing them, that we come gradually to think of them as natural and look upon them as a matter of course.

"The time will come when the work of the Physician will not be to treat and attempt to heal the body, but to heal the mind, which in turn will heal the body. In other words the true Physician will be a teacher, his work will be to keep people well, instead of attempting to make them well after sickness or disease comes on; and still beyond this there will come a time when each man will be his own Physician.

"In the degree that we live in harmony with the higher laws of our being, and so, in the degree that we become better acquainted with the powers of the mind and spirit, will we give less attention to the body— not less **care but less attention.**

'The bodies of thousands to-day would be much better cared for if their owners gave them **less thought and attention.** As a rule, those who think least of their bodies enjoy best health. Many are kept in continual ill health by the abnormal thought and attention they give them.

"Give the body the nourishment, the exercise, the fresh air, the sunlight it requires, keep it clean and then think of it as little as possible. In your thoughts and in your conversation never dwell upon the negative side. Don't talk of sickness and disease. By talking of these you do yourself harm and you do harm to those who listen to you. Talk of those things that will make people the better for listening to you. Thus you will infect them with health and strength and not with weakness and disease."

To dwell upon the negative side is always destructive. This is true of the body just as it is true of all other things in life. The following advice is of special significance and value in this connection; it comes from a Physician who has made extensive study and observations along the lines of the powers of the interior forces:

"We can never gain health by contemplating disease, any more than we can reach perfection by dwelling upon imperfection or reach harmony through discord. We should keep a high ideal of health and harmony constantly before the mind .. . .

"Never affirm or repeat about your health what you do not wish to be true. Do not dwell upon your ailments nor study your symptoms. Never allow yourself to be convinced that you are not complete master of yourself. Stoutly affirm your superiority over body ills and do not acknowledge yourself the slave of any inferior power .. ..

"I would teach children early to build a strong barrier between themselves and disease by healthy habits of thought, high thinking and purity of life, I would teach them to expel all thoughts of death, all images (imaginations) of disease, all discordant emotions, like hatred, malice, revenge, envy and sensuality, as they would banish a temptation to do evil. I would teach them that bad food, bad drink or bad air makes bad blood; that bad blood makes bad tissue, and bad flesh (makes) bad morals. I would teach them that healthy thoughts are essential to healthy bodies as pure thoughts to a clean life. I would teach them to cultivate a strong will-power and to brace themselves against life's enemies in every possible way. I would teach the sick to have hope, confidence, cheer. Our thoughts and imaginations are the only real limits to our possibilities. No man's success or health will ever reach beyond his own confidence; as a rule, we erect our own barriers.

"Like produces like the universe through. Hatred, envy, malice, jealousy and revenge all have children. Every bad thought breeds others, and each of these goes on and on, ever reproducing itself until our world is peopled with their offspring. The true physician and parent of the future will not medicate the

body with drugs so much as the mind with principles. The coming mother will teach her child to assuage (calm) the fever of anger, hatred, malice with the great panacea of the world—Love. The coming physician will teach people to cultivate cheerfulness, goodwill and noble deeds for a health tonic as well as a heart tonic, and that a merry heart does good like a medicine."

The following is from the Book of Knowledge and sums up what we said above: --

"It is strictly true to say that some people are older at 40 than others are at 70. This teaches us that it is not the mere passage of time that makes us old, but what is happening during that time in our bodies. People who lead wise lives, especially people who do not eat too much or drink too much, and who get enough sleep, during which the body gets rid of and destroys many of the poisons it produces in the daytime, do not grow old nearly so quickly as other people. Also this is true of people who have quiet minds; great worry or sorrow "ages" people as we say; it interferes with the power of the body to recover from exertion and to get rid of its poisons; and so unhappy or fretful people get old more quickly than those who lead calm and happy lives. The people who take longest to get old are those who act on two good proverbs:

"The best Doctors are Dr. Quiet, Dr. Diet and Dr. Merryman," and

"Joy and Temperance and Repose,
Slam the door on the Doctor's nose."

Hypochondriasis

This is a chronic nervous disorder characterised by mental depression due to "needless anxiety about the health." It is really a slight form of insanity akin to melancholia. (Literally hypochondriasis means a condition dependent on the organ situated under the ribs, that is, the liver, and melancholia means black-bile, and both the conditions were once regarded as dependent upon the condition of the bile secreted by the liver).

The disease is much more common in males than in females

and occurs chiefly in adults. The patient is constantly thinking of his health, inspecting his tongue, evacuations, talking of his ailments (which are of course imaginary—maladie imaginaire) and consulting books and doctors. They often refer their complaints to the same organs, such as the stomach, liver, sexual organs or brain. A trifling uneasiness about the stomach will suggest cancer, occasional palpitation point to heart disease and constipation to serious obstruction of the bowels; and a few nocturnal emissions may be interpreted as certain forerunners of impotence. With his thoughts constantly directed towards himself and bent on studying, and discovering further symtoms of his supposed organic ailment, the patient naturally magnifies any little abnormal sensation, and this grows in intensity with the attention bestowed on it. Under such circumstances, with internal phenomena occupying so large a share of consciousness, it is natural that the consciousness of external things should be diminished, and that the patient should imagine that his memory is being lost.

Careful and repeated examination by the physician often reveals no disease whatsoever or at most some trifling change which is quite insufficient to justify the patient's anxiety.

Hypochondriasis is specially apt to occur in people with a family tendency to insanity, and in many cases there is or there has been some bodily ailment which may be regarded as its exciting cause. Disturbances of the digestive system especially dyspepsia, constipation, piles, etc. are among the most common causes. Though the mental depression is great there is no suicidal tendency as is commonly present in melancholia.

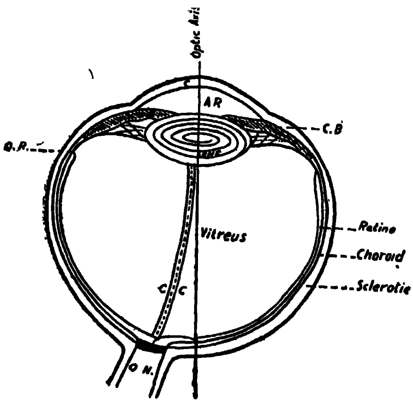
Hypochondriasis depending on a neurotic heredity usually persists through life; but the acquired form may undergo improvement or cure. Occasionally it ends in melancholia.

The correction of any bodily error that can be discovered such as dyspepsia, constipation, bleeding piles, varicocele etc., the correction of alcoholic and sexual habits and stoppage of excesses in these directions, tonics, change of scene with change of occupation ensuring a certain amount of bodily exercise, fresh air and rest—all these may be helpful. The patient should

be encouraged to educate himself to disregard the symptoms which he has been in the habit of attributing to serious disease.

VII. The Care of the Eyes

The structure of the Eye. Fig. 22 represents an antero-posterior section of the eye ball through the middle. The



C.—The Cornea
Aq.—The Aqueos
I.—The Iris
C.B.—The ciliary body
C.C.—The canal of Cloquet
F.C.—The Fovea centralis
O.N.—Optic nerve
O.R.—Ora serrata.

Fig. 22.

Cornea (c) is a firm transparent hemispherical horny structure set in the sclerotic like a watchglass. The curvature of the Cornea is important. In the normal eye it is curved almost equally in the horizontal and vertical planes, so that the rays of light which pass through these planes are equally refracted. In Astigmatic eyes, on the other hand, the curvatures are unequal, with the result that when the rays of one plane are in focus on the Retina, those of the other plane are not, so that objects appear indistinct.

Behind the cornea is the anterior chamber; it is filled with the Aqueus (Aq.); it is bounded in front by the cornea and behind by the Iris (I) and part of the anterior capsule of the crystalline lens exposed in the pupil. The anterior chamber communicates with the posterior chamber. The latter is, therefore, bounded in front by the posterior surface of the Iris

and behind by the Lens-in-capsule and the suspensary ligament of the Lens (which is seen in the figure just behind the ciliary body (C. B.). The posterior chamber also contains aqueus.

The **Iris** (I) is a circular diaphragm with a central opening, the pupil. It is composed of a pigmented stroma of cells and is richly supplied with blood vessels and nerves. Near the pupillary margin there is a bundle of involuntary muscle fibres (the Sphincter of the pupil) which enables the pupil to contract and dilate as required.

The **Ciliary Body** (C. B.) is also similar in structure to the Iris, and the Iris is attached to it about the middle of its base. The Ciliary body extends backwards as far as the ora serrata (O. R.) at which point the **Retina** proper begins abruptly.

The **Choroid** is an extremaly vascular membrane lining the Sclera from the inside. Its function is to nourish the outermost layer of the retina.

The retina corresponds in extent to the choroid, which it lines. It is an exceedingly complex structure and is composed of nervous elements which extend from the Optic Nerve to the Ora serrata. The retina consits of several layers; the most important part concerned with vision is the "rods and cones" layer.

The Crystalline lens is a colourless perfectly transparent elastic body, biconvex in shape. It has no bloodvessels (except in the foetus, when it is nourished by the hyaloid artery running in the hyaloid canal; after birth the hyaloid artery obliterates sometimes leaving the hyaloid canal intact, the canal of cloquet (C. C.) After foetal life the nutrition of the Crystalline lens is carried on by the fluid secreted by the ciliary body.

The lens consists of fibres arranged in concentric layers (as in an onion) and enclosed in a capsule, The encapsuled lens is retained in position by the suspensary ligament, which consists of fibres passing from the elevations of the ciliary body to the capsule of the lens and are attached to the retina near the ora serrata.

As age advances the lens becomes firmer, its elasticity

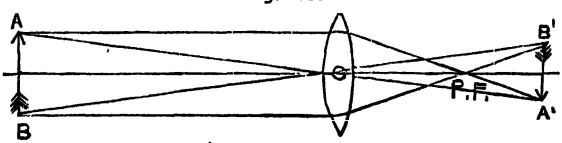
diminished and the central portion becomes sclerosed or hardened. The function of the lens is to collect rays of light and focus them on to the retina, and for this reason it is elastic and compressible.

The Vitreous Chamber is filled with a transparent gelatinous substance enclosed in the hyaloid membrane and is intimately attached to the retina and is in front adherent to the suspensary ligament of the lens.

Physiology of the Eye. The Dioptric or the Optical System of the eye is formed by the transparent structures consisting of the cornea, the aqueus, the crystalline lens and the vitreus. When rays of light pass from one medium into another of greater density the rays are deflected out of their original course, or "refracted;" in fact, the combined effect of the dioptric media is equivalent to that of a convex lens, so much so the rays of light come together at one point called the "focus."

Now, in the case of a glass-lens there is what is called a Principal Focus, (P. F.) (Fig. 23), which is a point at which

Fig. 23.



Parallel rays from object A B converging through the convex lens at P F and producing an inverted image B'A'

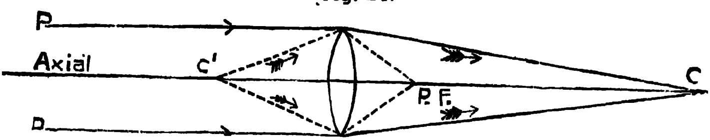
parallel rays, (those coming from a distance of 6 meters(=20feet) or more) are focussed on the other side of the lens. But the rays of light coming from a nearer object are no longer parallel but are divergent when they reach the lens, and they are brought to a focus at a point further from the lens than the Principal focus; and the nearer the object is brought to the lens the further its focus will be on the other side of the lens. (See Fig. 24).

In the normal eye—The Emmetropic eye—the P. F. of the dioptric system coincides with the retina, that is to say, a distant object (object situated at 6 metres or more from the eye) will

cast an inverted and clear image on the retina; when the object is brought closer to the eye, the rays of light proceeding from the object are divergent. Such rays after refraction would naturally cast an image beyond the P. F., that is, behind the retina. Hence such an image will still be inverted but a blurred one. This difficulty is overcome by "Accommodation." (Accn.)

The eye is compared to a photographic camera, the circular diaphragm with its central aperture corresponds to the Iris with its pupil, the photographic lens corresponds to the crystalline lens and the sensitive plate to the retina. In a camera the focussing for a near object is brought about by lengthening the distance between the lens and the sensitive plate by carrying back the plate to a point where the divergent

Fig. 24.



Parallel rays proceeding from P P converge at P F. Divergent rays from C' from a point nearer than 6 meters are focussed at C on the other side of the lens **beyond P F**

rays are brought to a focus. But the anteroposterior diameter of the eye (or the length of the eye) cannot be altered in this way, and the same result is attained by increasing the converging power of the lens, so that the divergent rays from a near object are brought to the same focus as the parallel rays from a distant object. This increase in the converging power of the lens is known as "accommodation" referred to above. Accn. is therefore the act of altering the focus of the eye so that divergent rays (or rays coming from an object nearer than 6 metres from the eye) are brought together on the retina. It is accomplished by an increase in the convexity of the Crystalline lens and consequently in its refractive power. Hence the degree of Accn. must vary with the nearness of the object to the eye.

The function of Accn. can be demonstrated in the reading of small print. If the print is brought closer and closer, a point will be reached at which the print can still be clearly seen; but closer than this point it is impossible to read the print. This is called the Near Point (N. P.) of Accn.

The lens, as already mentioned, is elastic, but as age advances it becomes stiffer and less elastic, so that at advanced age the elasticity is practically nil. Hence the power of Accn. becomes also diminished, and the Near Point (N. P.) recedes from the eye until at about 40 or 50 years of age it is so far from the eye that reading or near work can no longer be performed without effort. We say at this stage that "far sight" or presbyopia has resulted. Naturally it is at old age that farsight (figuratively) begins also. Now, Presbyopia is only a physiological condition and has to be corrected by the use of convex lenses for near work.

Now Accn. is always accompanied by contraction of the pupil. Therefore, when we look at a near object not only the pupil contracts but at the same time the two eyes are turned inwards in the direction of the nose, or "converge."

The pupil may, however, contract when a strong light falls on the retina, the effect of the contraction being a clear image of the object on the retina, This is what the photographer brings about when he wants a clear image to be cast on the sensitive plate in case of excessive light on his object, he puts in a diaphragm with a small hole.

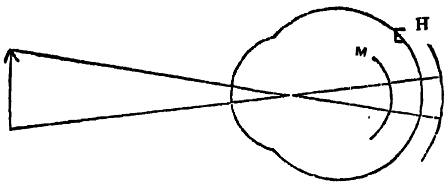
The Retina is concerned in the perception of light, form and colour. The light-sensitive part of the retina is the "rods and cones" layer, and when light falls on these certain electro-chemical changes result in the transmission of nerve impulses through the retina and the optic nerve to the brain.

We saw that in the normal or Emmetropic (Standard) eye rays of light coming from a distance of six metres or more (or parallel rays) tend to focus on the retina after passing through the optic system formed by the cornea, the aqueus, the crystalline lens and the vitreus. (Fig. 25). On the retina a clear inverted image is formed, which becomes re-inverted psychologically in the brain.

In some eyes, however, the retina is not situated in exactly the right place for the images of distant objects to be clearly focussed on it; it may be either too far forward or too far back and so only a blurred image is formed on the retina. Such eyes are called Ametropic eyes (eyes off the Standard). Now Ametropia may be: (See Fig. 25).

(1) Hypermetropia or Hyperopia (H.) in which parallel rays (rays coming from distant objects) do come to a focus

Fig. 25.



M = Myopia
E = Emmetropia
H = Hypermetropia.

behind or beyond the retina ("hyper" means "beyond"), and divergent rays (rays coming from near objects) tend to focus further behind. In H. therefore, distant or even near objects cannot be distinctly seen without Accn. Hence to enable such an eye to see distinctly objects at a distance the convexity of the crystalline lens should be increased by Accn. or the use of convex glass-lenses; for near objects this Accn. is much more than in the case of normal eyes. Henoe in H. the Accn. is constantly at work, such an eye is never at rest and is apt to suffer from eyestrain (asthenopia) unless a suitable convex lens is worn.

(2) Myopia (M.)--Commonly known as "short-sight." In this condition parallel rays do not focus on the retina, but do so in front of it (i. e. short of the retina). Hence in M. distant vision is indistinct; but near work can be done without discomfort. But in myopia, there is a point, the Myopic Far Point (Punctum Remotum, P. R.) rays coming from which are focussed on the

retina without Accn. and represents the greatest distance at which the patient can read fine print; and the higher the myopia the closer is the P. R.

In High Myopia distant vision is very indistinct and the patient screws his eyes in order to increase the antero-posterior diameter of the eye so as to take the focus backwards on the retina; the patient will be unable to continue close work on account of excessive convergence.

In myopia, clear distant vision can therefore be restored by the use of diverging or concave lenses.

(3) Astigmatism (Ast.) In this condition the degree of refraction of rays is different in different meridians, that is, on account of the difference in the curvature of the cornea each principal meridian has a different focus from the principal meridian at right angles to it, one exhibiting maximum refraction and the other minimum. The back of the bowl of a spoon is an exaggerated example of an astigmatic surface, the curve from side to side being much greater than that from the handle to the tip. On account of the difference in the refractive power of the cornea the image thrown on the retina will be very indistinct. Eyestrain is therefore apt to be produced if not corrected by suitable cylindrical lenses, convex or concave as the Ast. is hypermetropic or myopic.

Binocular Vision

The primary position of the eye is the one which it occupies when the gaze is fixed at a distant object and in the horizontal plane level with the eye; from this primary position it is capable of rotating in all directions, these various movements being effected by the various extrinsic muscles. The mobility of the eye-ball, therefore, enlarges the Field of Fixation, that is, the field within which the eye can obtain central vision without movements of the head.

The eye is not a single organ but a paired one, that is to say, the action of the movements in the two eyes is co-ordinated, so that the visual axes are always directed simultaneously towards the same object: Binocular Vision (B. V.) thus results. In

Binocular Vision the retinal images, one each seen by either eye are fused into one in the brain so that the object fixed at appears as a single object and in relief. In fact, B. V. enables us to obtain more complete knowledge as to distance, shape and solidity of objects, and we have much larger field of vision than that afforded by one eye.

Eyestrain

This is essentially a nerve strain from the use of eyes and may cause certain disturbances usually described as headache, pain in the eyes and chronic sore eyes. The form in which eye-strain shows itself is to some extent dependent upon the age of the patient.

1. In early child-hood the presence of Hypermetropia is usually associated with convergent strabismus or squint from excessive strain of Accn., and the condition is permanently cured by the use of suitable lenses. Chronic conjunctivitis (inflammation of the mucous membrane of the eye), Blepharitis (inflammation of the eyelids) or both are also the result of eyestrain, and are explained by the excessive congestion produced by persistent strain. Twitching of the lids, of the face, choreic movements and even epileptiform seizures may result from eyestrain in the young. Usually they are associated with exceptionally high degree of Ametropia, but even a moderate error of refraction in neurotic children, or children convalescent from acute diseases may help to establish or perpetuate such disorders. In rare cases there may be nausea, vomiting and car-sickness (while travelling in cars or trains) and migraine-like attacks (sick headache) in children.

Eyestrain often influences mental development in children and arrests bodily growth.

(See, Eyesight and the Backward child Page 502).

2. During school-life—Eyestrain from ametropia or bad habits in using the eyes is the most common cause of headache (frontal or occipital). This is the period for the production of myopia by undue and continuous exercise of convergence. Simple myopia may not be attended with headache, but myopic

Ast. usually is, and the headache may persist even in later life. Infact many cases of habitual headache encountered later in life have been developed and fixed by eyestrain during school-life.

More directly connected with the eyestrain of myopia are aching of the eyeball, divergent squint with headache and vertigo (dizziness) from muscular asthenopia (eyestrain from muscular weakness).

3. In early adult life the occupation of the patient is most likely to determine the occurrence of eyestrain. Indoor occupations such as needle-work, writing or typing or such kind of office work, watching faces as by teachers, and salesmen, fine mechanical trades and reading required in various professions predispose most. Among such people headache is the commonest result of eyestrain; but many other symptoms like anorexia, (want of appetite), dyspepsia, nausea, poor nutrition, anaemia or even a neurasthenic condition may result from eyestrain and should lead the physician to suspect eyestrain as one of the possible causes of ill-health. Those who live chiefly out-door lives commonly escape all such disorders unless they are highly myopic or astigmatic.

4. With middle life the diminished power of Accn. may cause eyestrain in those whose eyes have previously given perfectly satisfactory service without undue nerve-effort. Headache, vertigo and migrainous attacks may develop. Often there is ocular congestion or even chronic catarrh attended with burning sensation in the eyes, which many a time cannot easily be distinguished from senile conjunctivitis and resists all local medicament; but the removal of eyestrain by suitable glasses immediately affords relief.

5. After about the 50th year the Accn. becomes weaker and if the Reading glasses do not suit properly, eyestrain is avoided unconsciously by the patient either by shifting the glasses a little further from the eyes or looking through them obliquely. But, for Distant vision glasses are many a time required also even in patients who did not feel their necessity earlier; because at this age a form of Hypermetropia is developed sometimes with Astigmatism. In such people therefore, there is the eyestrain of Distant vision. The symptoms of eyestrain coming on

gradually at this age are therfore likely to be over looked or misinterpreted. Such patients may not complain of any inconvenience whatever except perhaps a little watering of the eyes or inability to concentrate attention on what is read. The disturbance is, therefore, likely to be considered senile, but the relief is atonce apparent when proper distant glasses are used.

Eyesight and the Backward Child

. It is necessary to draw the attention of teachers to the fact that failure or want of success in teaching and education is not in a great number of cases due to want of gift, negligence, laziness or obstinacy on the part of the children, but to the fact that such failures must be traced to some ametropic defect in the child, the correction of which by suitable glasses has been neglected. It should be admitted that a child suffering from noncorrected myopia cannot possibly follow a teacher in his lesson, if it is not able to make out or discern the writing on the black-board, the map on the wall or the necessary illustrations in object-lessons. The teacher will be able to observe that some children show good and progressive results in those branches of instruction, where oral teaching was given, and on the other hand, he would find the same children to be backward in those branches of instructions where the teaching was chiefly appealing to the eyes. It was not the child which was to blame if it was not able to get on at school.

It is common experience that some children cannot be made to adhere to the marked horizontal lines while writing. Instead of drawing the conclusion of obstinacy, stubbornness, carelessness or superficiality on the part of the child, investigation should first of all be made as to whether the child was not suffering from Astigmatism, which made it impossible for him to clearly discern the horizontal lines. As a rule it was likewise due to Astigmatism if a child inclined the head to one side or even supported the head with the hand when looking at the black-board or the map on the wall. Such an attitude which is often reprimanded as being indolent or inattentive or ill-mannered should first of all give rise to the question whether it was not

a case of existent astigmatism before the child was possibly misjudged in its behaviour or even punished.

With its head erect a child was perhaps not able to read what was written on the blackboard in vertical lines and it therefore held the head in such a position which best enabled the eye to see clearly.

Nothing could possibly prejudice education more than the unjust treatment of a child inspite of its doing its best to go on, and for that reason it must be demanded that greater attention is paid to the eyes of children. It is with this purpose also that Medical Inspection of school children is insisted upon by the Education Boards.

Temperament and Defective Sight

It has already been pointed out that a child with uncorrected Hypermetropia is looked upon in school as stupid and backward. He starts life handicapped with an inferiority-complex in consequence, and it is only when he complains of headache or develops a squint that interest is taken in the child by his teachers and parents, and correction of sight is made. Failure in this direction often therefore turns out an average or even superior intellect.

Very different, however, is the state of a congenital myope. Although his visual acuity for distance is very much below normal the retinal image of objects close by is much larger than that in the normal eye. Printed type appears, therefore, to his eye much larger than to a normal eye; as a result he learns only from the printed word, which becomes the absolute law of his life. Seeing nothing sharply beyond his limited horizon he learns little by observation, nothing by experience and his main source of learning is print. He is, therefore, from an examination point of view "clever" and passes his school-life at the top of his class. He has little interest in his athletics, for he cannot see at a distance; but in reading, mental problems such as cards, chess and puzzles he finds relaxation or recreation—all within a few feet of his eyes. What is the result? He grows up saturated with precedents culled from books, which are practically the only

contacts he has with the outside world. Myopes are, therefore, myopes physically and mentally too.

If, however, the myopia is corrected early in life this mental deficiency is largely counteracted also, though even then there will be definite inferiority-complex, may be less in degree.

We, therefore, see that temperament is often unstable and plastic and has to be moulded in the young either by their surroundings or by example and liable to be influenced by defective vision, disease or physical infirmity.

Preventive Treatment of Myopia

This is indicated even from childhood, the general advice given being to stop excessive close work of any kind especially in artificial light. Teaching of the young should be done mostly by demonstrations; the seats and desks in schools should be adjustable so that the child is compelled to sit up and keep at a reasonable distance from his book; the light should be good also and always come from over the left shoulder to avoid the alternative of bringing the print closer to secure a larger image. No small print or fine needle-work is permissible for the same reason. Reading in bed or lying on one side only while reading should be avoided, as this necessitates an unnatural muscular action. Continuous application should be discouraged and periods of rest should alternate with periods of work.

Infact, it is a safe rule to follow that no child under 7 who has one or both parents myopic should be allowed to learn to write or read. High myopia is hereditary and runs in families and is often the result of consanguinity of marriage (between blood-relations).

Effects of Light and Glare

The ultraviolet rays or "actinic" rays are believed to damage the retina when it is exposed to excessive irradiation by them. Special glasses, (Crook's glasses) have been devised which have the power to absolutely cut off the harmful rays and protect the eyes from their action; but ordinary glass also cuts out most of the ultraviolet rays though not to the same extent as

Crook's. To prevent damage by glare it is therefore necessary to employ tinted glasses of some sort, not necessarily Crook's—any of these will give adequate protection against ultraviolet rays.

When excessive light falls on the retina temporary or permanent blindness of part of the retina—scotoma (dark spot in the field of vision) - may result from the damaging effect of the excessive light-rays. Such a result occurs in Eclipse-blindness; but the most usual result of glare is head-ache, caused by over-stimulation of the retina by the bright light. Dark glasses are the well-known means of prevention. They should be used by all who are exposed to excessive glare.

Neutral tinted (smoke glasses) or green—yellow (chlorophyll) tinted glasses may be used according to taste. Amber-coloured glasses are also useful, they give a clear definition of distant objects even in glare, as the glare is rendered by them more bearable by the Retina and the Iris.

The Infra-red rays are said to cause cataract among glass-blowers, while the ultraviolet rays cause sometimes intense inflammation of the conjunctiva—Film Star's Eyes, or Snow-blindness.

The retina is protected against intolerable radiation by the contraction of the pupil, and even if the pupil is very much contracted the absorption of the visible light by the retina at the sight of a bright image may even cause a burn of the retina resulting in blindness. This condition is fairly common in the tropics when an eclipse is observed either directly or through reflection.

(See also—Light for Reading Page 34).

Effect of Cinema on Sight

Magistrates and social workers are constantly heard to deprecate the effect of the Cinema on the youths of the Country, Sanitarians deplore the hours spent in dark over-crowded and often ill-ventilated halls when they might be spent in open air exercise. Pedagogues bewail the prostitution of a potential weapon for instruction. Medical Psychologists know some of the appalling damage done to national life and the home by the

early assumption that the wedding bells ring out the period of struggle and anxiety and ring in a halcyon period of effortless delight. But the Ophthalmologist is concerned more with the Cinema fatigue caused to the eyes. People with errors of refraction in their attempt to see clearly by narrowing the palpebral fissure or by excessive Accn. do complain more easily of fatigue of the eyes. The flicker, the vibration and the "rain" and the dazzle produce in them the fatigue sooner, and they complain of headache after. Uncomfortable seats, bad ventilation, colour-films—predispose to production of head-ache; watering and blinking eyes or sore eyes is common enough and is ascribed to difficulty in adapting the eyes from darkness in the hall to light outside the hall. It seems rational therefore to suggest long exit-passages with gradually increasing lighting from the darkness of the theatre to the brightness of outside streets.

People often have difficulty in finding their seats before their eyes become dark-adapted. This could be avoided by entrance passages getting gradually darker towards the auditorium.

Preventable Blindness

The number of the blind in the whole of India according to the Census of 1931 was about 600,000, but probably this figure is under-estimated. The main causes of blindness are:

(1) In Children—Keratomalacia, Optic Neuritis, Congenital Syphilis and hereditary blinding diseases.

(2) In Adults —Cataract, various Optic Nerve lesions mainly Syphilitic, Ulcer of the Cornea, Glaucoma and Trachoma.

(3) In Children and Adults—Irritant remedies and small-pox.

Blindness in children is much more common in India than in any civilised and progressive country of the West. The Madras Census Report with all its inaccuracies and defects shows a general figure of 150 for every 100,000 of population, whereas in England and Wales there have been only 119 blind per 100,000 population. Statistics of England and Wales as to "age"

incidence shows that about 20% became blind within the first year of birth. Such an incidence in India must, for several reasons, be much higher.

The cause of such enormous percentage of blindness in India seems to be,—first and foremost—ignorance and want of education among the masses. People are unable to recognise the seriousness of eye complaints being ignorant of their consequences, so that medical advice is not sought until too late even when available easily and without cost as in large Cities of India. In the remote villages, however, the poor sufferers depend entirely upon the indigenous quack, who being himself ignorant of the nature of disease can be considered responsible for a large number of cases of blindness; moreover his methods are rough and primitive and his medicaments crude and highly irritating to the eyes, converting perhaps a case of simple sore-eyes (which may heal in a few days without special care) into a serious corneal ulceration with subsequent destruction of the eye. Elliot in his Tropical Ophthalmology gives pictures of eye-patients being treated by Indian Quacks with applications prepared on a dirty spade of the field or a broken piece of mud-ware. Whatever may be the curative properties of the remedies employed by these quacks the preparations are grossly dirty and irritant, and one can imagine what amount of harmful effect they can produce on an already inflamed eye.

Next to ignorance there is the factor of poverty of the masses that has also to be taken into consideration in this connection. The dietary of the poorer classes especially among growing children thereby suffers, becomes wholly devoid of certain essential or "Protective" substances like proteins, salts and vitamins, which we have seen are so important for healthy growth; so much so, their general vitality is very much lowered and disease readily sets in. According to McCarrison, we have seen, faulty nutrition is the great basic cause of the bulk of the ill-health in India.

The so called "deficiency diseases" of the eye, we have seen, are: (1) Xerophthalmia or Xerosis due to deficiency of vit. A in diet. It is possible also that deficiency in diet in other

directions, such as proteins and calcium and phosphorus salts may act as an adjunct cause. In this condition, the reader is reminded, the conjunctiva of the eyeball becomes pigmented or even jaundiced, dry and lustreless, and appears covered with a material resembling dried foam. Associated with the condition there is usually night-blindness of a functional nature. We saw that the condition is thought to be due to deficiency of vit. A for several reasons: It has been experimentally produced in animals by withholding completely vit. A from their diets and proved to be curable by giving Cod Liver Oil, mammalian or birds' liver or red palm oil,all these being rich in vit. A. Aykroid (now of the Coonoor Institute) made the following observations in 1929 in Newfoundland and Labrador: The diet of a series of cases of Xerosis with night-blindness was found to be obviously deficient in vit. A; in some patients the disease developed in less than a month after the patient had passed from a diet rich in vit. A to one which was totally devoid of it. The condition of the country, says Aykroid, and the mode of life followed by people made it difficult or impossible to obtain proper food. All these cases, he says, were curable, especially the night-blindness by one or two doses of Cod Liver oil. Two fishermen, he adds, had cured themselves by eating half a sea-gull's liver.

(2) Another disease of the eye due to deficiency of vit. A is Keratomalacia, where the cornea becomes softened and destroyed resulting in complete blindness. The condition occurs mostly in children after the first year of life, but may also be found in older children and rarely in adults over 20 years of age The child usually suffers from marasmus and poor health from diarrhoea, enlarged liver and spleen. There is an accompanying condition of xerosis also, so much so, keratomalacia is considered by some to be an accentuated form of xerosis. The child is weak and apathetic and unable to close the eyes; gradully the cornea softens and peels off resulting in an irreparable condition of blindness. It is therefore important that active treatment should be resorted to at once as soon as the condition is recognised. Vit. A in the form of Cod liver oil or the cheaper red-palm oil is highly useful. But in the stage of keratomalacia the digestion is

so poor that the oil is not easily digested or absorbed from the accompanying condition of diarrhoea. In such cases, therefore, massaging with the oil (Cod liver oil or the red-palm oil), feeding the child on freshly drawn cow's milk or goat's milk and on fruit juice (oranges or tomatoes) raw potato juice or fresh spinach juice are helpful. These latter supply vit. C in abundance, which however, corrects any tendency to scurvy, that may be associated with keratomalacia.

Now Keratomalacia is possibly the most serious cause of preventable blindness in the Madras Presidency, and in any case is more serious than Ophthalmia Neonatorum (Gonorrhoeal ophthalmia of the newborn). In Bengal and Bombay the same view is held by eminent ophthalmologists, but in the Punjab, which is peculiarly free from deficiency diseases not only of the eye but of the systemic diseases like rickets, beri-beri, scurvy etc. the incidence of Keratomalacia is negligible. On the other hand in the United Provinces the position of this complaint is the same as in Madras or Bombay or Bengal. One of the great differences, we said, between the Punjab and other provinces of India which influences the occurrence of Keratomalacia is that the food in the Punjab gives a more complete diet, the inhabitants being largely wheat-eaters and not rice-eaters; moreover, the Punjabis consume larger quantities of milk products and other "protective" foods, that is, foods containing enough of animal proteins, salts of Ca and P and vitamins. Hence it is that there is very little deficiency disease in the Punjab. Prof. Duggan of Bombay says that the large number of cases of Keratomalacia met with in that province are chiefly among the itinerant classes (pardeshis) who live chiefly on chapati and dhal and use little of milk or milk products in their diet; that the disease is also prevalent among the children of working mothers in the industrial parts of the City of Bombay, the mothers while going for their daily work in the factories sometimes resort to drug the children with opium-pills (Bal-goli) to quiet them during the mothers' absence till they return home in the evening. Meanwhile the children would be starving also. The effect of starvation and drugging with harmful drugs, insufficiency of food and of proper quality—all combine to wreck

the constitution and predispose to disease. Matters seem to have improved ever since the starting of "creches" by the Children's Welfare Association, where the children of the working classes do receive adequate attention regarding their food and cleanliness.

Now Breastfed children are less suscepitble to Kerato-malacia provided the mothers are healthy and their milk is of good quality.

The disease is very common in some of the famine-stricken areas of the Madras Presidency like Bellary and other Ceded Districts.

(3) Two other nutritional disorders occurring in children and causing blindness or impairment of sight are (a) certain forms of cataract occurring in young children and practically present from intra-uterine life and supposed to be associated with calcium metabolism and defective nutrition of the child while in utero. To prevent this condition the mother's diet should be carefully regulated during pregnancy and lactation. Vit. D is essential for calcium metabolism and is especially necessary during pregnancy and lactation; and can be derived from exposure to sunshine, the irradiation, as we have seen already, producing the necessary essential factors not only in animal tissues but in foodstuffs also.

(b) An excess of carbohydrates, such as sweets in children's dietary generally produces what is known as the "phlyctenular condition," which often persists long inspite of an apparent cure by proper treatment. If the cornea is affected a kind of opacity is left in that structure with possible interference with sight, not necessarily amounting to blindness.

(4) The next disease of the eye, which is a fruitful source of blindness practically from the first week of birth is Ophthalmia Neonatorum, a form of acute purulent type of inflammation of the conjunctiva of the eye occurring in the newborn, due to contagion of the eyes from the purulent discharges like gonorr-hoea or "whites" of the maternal genitals during the birth of the child. Col. Wright of the Madras Government Ophthalmic Hospital has collected statistics of the incidence of this disease

and also of Keratomalacia mentioned above. Oph. Neon. is of course common among the new-born, but Keratomalacia is much frequent at later age; the latter condition may also be found in children and even in adults. Blindness is a very much more common sequel in Keratomalacia than in Oph. Neon; in fact, it is much rare to lose an eye from Oph. Neon. unless the cornea is already badly damaged before the case reports to treatment.

It is a regrettable fact that even in cases attended to at birth by a qualified midwife. the incidence of Oph. Neon. is apalling. This, therefore points to the greater importance of better and more insistent teaching in connection with the prophy-laxis or preventive treatment of Oph. Neon. Measures ought to be adopted in this Country similar to those adopted in European Countries in this respect. When the incidence in the City of Madras among cases born in special maternity institutions is so high, it is probable that the situation is much worse in the mufassil.

Fortunately gonorrhoeal ophthalmia, whether in the new-born or in the adult, does not seem to be as destructive in India as in Europe. Whether this is due to the greater resistance power of the Indian to the disease or to the diminished virulence of the causative organism, it is difficult to say. Dr. Heppel, the Venereologist of the General Hospital, Madras is of opinion that gonorrhoeal urethritis does not appear to be such a severe affection or as difficult of treatment in Madras as it is in England. His experience is, therefore, in line with that of the Ophthalmic Surgeons in Madras.

Herman estimates from a Home for Blind Children, that 50 p. c. of cases of blindness are due to Oph. Neon. Statistics of children of school-going age in England show that about 20 to 30 p. c. were due to this disease.

Though a preventable disease, there is, unfortunately, no evidence of reduction in incidence in recent years although there is evidence of a reduction in the amount or degree of blindness caused by it; but this is due rather to more advanced methods of treatment. If trained midwives are made available to poorer classes and efficient medical aid established for all

children in rural parts much of the blindness from Oph. Neon could be prevented. (See Crede's Preventive Method).

(5) Smallpox is no less important in the production of blindness, which is easily preventable by timely vaccination. But some people are averse to vaccination and actually avoid it or postpone it on some pretext or other. It must be remembered that smallpox is more severe in the non-vaccinated than in the vaccinated, and that the severer the disease the greater are the chances of the eyes being affected also.

The percentage of blindness due to small-pox alone was once estimated as high as 25 p. c. of the total number of blind cases in India. But the figure is considerably less now, not only due to introduction of compulsary vaccination and lesser incidence of small-pox thereby but also to better methods of treatment of the eye-complications of the disease.

(6) Cataract--This is a disease of the crystalline lens of the eye, in which its transparent substance becomes opaque, and rays of light from external objects are prevented from passing through it and casting their image on the retina, the result being impairment of vision or varying degrees of blindness. (It is so named as it was believed that it was due to "the flow of a watery humour down into the eye," the word having been derived from Greek, katarrasso, meaning to fall down, as of water-falls).

In this article headed "preventable blindness" we are not, strictly speaking, concerned with cataract, as cataract cannot be prevented, but if properly treated should yield best sight. But in our Country, unfortunately, there is the itinerant Hakim who has his own method of treating the disease; and while the surgeon "takes out" the cataract by operation and restores sight, the Hakim "couches" it by pushing it back by means of a needle or special instrument devised for the purpose; in this case the couched cataract acts as a foreign body in its new situation and produces certain untoward results, ending in several instances in slow or rapid destruction of eye-sight; so much so it is estimated that in only 10 p. c. of couched cases that sight of varying acuteness is present. 90 p. c. of the cases therefore end in blindness.

(7) Trachoma or Granular Ophthalmia or Egyptian Ophthalmia, is a very chronic disease and usually ends in corneal opacity and atleast partial blindness. If the disease is treated in time most of the serious complications could be avoided. It is estimated that about 3 or 4 p. c. of all cases of blindness is due to this cause.

(8) Blindness may also be the result of congenital syphilis, which usually shows itself as an opaque condition of the transparent cornea, but it may affect any part of the eye, usually the choroid and the retina, and may produce blindness if not treated energetically and in time. Luckily at present we have good specifics, better than some years ago, and if the patient resorts to scientific treatment in time there need be no anxiety about the prevention of blindness. It is estimated that in Western Countries more than 50 p. c. of all cases of blindness are due to syphilis, congenital or acquired.

(9) Glaucoma is another condition of the eye which produces blindness. In this condition there is a considerable rise in the intraocular pressure or "tension" interfering with the nutrition of the delicate retinal structure and causing blindness. We do not know of any preventive measure against this condition, but we can prevent blindness by timely treatment.

(10) Hereditary blinding diseases are best prevented by **"sterilisation of the unfit"** or preventing them from marrying.

Now, much of the blindness we meet with in India is certainly preventable. What is essential is the education of the masses and establishment of proper relieving measures in proper centres, and extension of the Maternity and Child-Welfare work in the rural areas. It is the duty of the State and the Public Health Department to find measures for the prevention of blindness on the lines above mentioned under the various causes.

Free distribution of educative pamphlets, drawing attention to the importance especially of Keratomalacia, Oph. Neon. and Small-pox, and denouncing the practice of couching of Cataracts; penalising quack-treatment especially of irritant applications to the eye and the "couching" operation will tend to greatly help in the reduction of "mortality among eyes."

Distribution of posters on the above subjects in Health-Week Centres, Schools and Colleges and other public places should be done. Standardised lectures on preventable blindness to senior students and teachers in Colleges and Training Schools will no doubt tend to disseminate knowledge regarding the question.

It is pointed out that propaganda work is at present being carried on in several large Cities of India in this direction; and it is hoped that before long figures of blindness in our Country from preventable causes would reach their minimum.

PART IV

The Expectant Mother & Her Child

PART FOUR

The Expectant Mother and Her Child

I. PREGNANCY

Pregnancy is not a "**nine months' disease,**" but only a physiological state and may be regarded as a normal phase of the female life-cycle similar to that of puberty and the menopause; nevertheless it carries a certain liability to disorders characteristic of the condition. The pregnant woman is not immune to the ills to which she has previously been exposed or particularly susceptible, and any latent or quiescent abnormality or chronic disorder is likely to be kindled to renewed activity during pregnancy; moreover, pregnancy stimulates almost every tissue and organ to function at a higher intensity.

Certain changes do occur in the maternal organism as a result of conception. Except during pregnancy the sole function of the mature uterus (womb) is that of menstruation. It usually measures about 2½" in length, 1½" in breadth and ¾" in thickness and weighs 1½ ounces in the nullipara (a woman who has not borne children) but is slightly larger and weighs more in the parous (one who has had pregnancy and delivery) non pregnant woman. With the advent of pregnancy certain new functions are assumed by the uterus, viz, the protection of the growing embryo, development of a mechanism for its nourishment and hypertrophy or growth of muscular tissue sufficient for the expulsion of the embryo at full term (delivery). When full growth is completed as at full term of pregnancy the weight of the uterus has reached more than 2 lbs., while its capacity has increased over 500 times.

The rapidity or intensity of these changes, it must be said,

is only exceeded by the subsequent reversal of the process, the involution of the uterus (or its return to the original size and weight) after delivery, when the normal conditions are restored in fewer weeks than the number of months required for the full growth of the pregnant organ.

It is customary to consider that the duration of pregnancy is 10 lunar months of 4 weeks each, that is 280 days, counting from the first day of the last menstruation. In practice, however, we find that considerable divergence from this period is often met with.

The predominating characteristics of the uterus in pregnancy are: (1) its enormous capacity for distension as in cases of multiple pregnancy, hydramnios (presence of excess of the amniotic fluid in the uterus), and (2) retractability or the power to close down promptly as the cavity diminishes in size after delivery (when the foetus and the placenta have been expelled). (3) The most significant alteration in the uterus during pregnancy is the susceptibility of the organ to infection. It is no exaggeration to state that it is almost impossible to infect a nonpregnant uterus. Even the gonococcus (the most virulent type of micrococcus) migrates from the vagina through the cervix (or neck of the uterus) to the Fallopian tubes situated at the fundus or top of the uterus one on either side affecting only the mucous lining (endometrium) of the uterus. With the advent of pregnancy the organ becomes unusually prone to invasion by pyogenic (pus-forming) microbes, as is demonstrated in the severe septic infection which generally follows crude attempts at producing criminal abortion.

As pregnancy advances certain symptoms are liable to be produced by the pressure of the growing uterus on the neighbouring organs, such as the urinary bladder in front and the rectum behind. Hence frequency of urination occurs, especially about the 4th month of pregnancy (when the bladder is compressed by the early growth of the uterus prior to its rise into the abdominal cavity); and next in the last weeks of pregnancy when the advancing head of the foetus encroaches upon the area into which the bladder nearly extends.

Direct pressure of the pregnant uterus on the rectum is uncommon because the uterus is normally inclined to the front. It is generally stated that the liver, the kidneys, and the stomach are not affected by the growing uterus. But functional disturbances of the stomach and the intestines are so frequently associated with the later months of pregnancy when the top of the rising uterus approximates the stomach-area that some mechanical interference with the normal motility of the stomach and intestines does give rise to flatulence, hyper-acidity etc.

The height of the fundus uteri (top of the womb) is a valuable guide to the progress and duration of the pregnancy especially in the absence of an accurate menstrual history. Normally the fundus should reach the level of the umbilicus (navel) at the VI month, midway between symphisis pubes and the umbilicus at the IV month, midway between umbilicus and the xiphisternum (ensiform cartilage) at the VIII month, and at the xiphisternum at the IX month. After the IX month the normal settling process of the womb usually carries the fundus down to the level of the VIII month. (This question will again be referred to while discussing the duration of pregnancy and the probable date of delivery). White lines (lineae albicantes, striae gravidarum, lines of pregnancy) do generally appear on the abdominal wall by distension and rarely on the thighs.

The reactions of pregnancy on the breasts appear early, and the signs and symptoms referable to them serve as valuable corroborative evidence in the diagnosis of pregnancy. The patient often complains of tenseness and sensitiveness in the breasts particularly around the nipple, often similar to that present in the breasts during menses, and generally felt as early as the III month. Itching is an occasional symptom and appears at later months when the skin becoms stretched. What are known as Montgomery's tubercles appear very early in a large number of cases. This is a constant sign. The tubercles are hypertrophied sebaceous glands arranged concentrically within the areola (dark ring around the nipple) and becoming more visible when the skin is stretched over them. The dark areola becomes broader and more pigmented—secondary areola, as it is called.

The nipples enlarge, become darker, also feebly erectile. Colostrum (thick milky fluid) may be expressed from the nipples, but this usually appears later in pregnancy and may even be absent until the last weeks of pregnancy. The general outline of the breasts follows no regular course. The breasts in multipara (in those who have borne children several times) are more often pendulous than in the primipara except in late pregnancy, when the added weight of the distended tissues causes them to droop often requiring artificial support. Varicocities (tortuousness) of the veins in the vagina and the legs, haemorrhoids or piles (which are also varicose conditions of the veins of the lower part of the rectum) are common in pregnancy. Oedema or dropsy of the feet and legs is common.

Nausea and vomiting of early pregnancy are striking symptoms but are by no means as common as generally believed.

Constipation is the rule in pregnancy and is usually of moderate degree, but patients often think it is a serious matter. The tendency to constipation is mostly due to displacement of the bowels brought about by the gradually enlarging uterus, the relative inactivity of the patient in the later weeks of pregnancy and the probable inefficiency of the power of bearing down due to the presence of the enlarged uterus.

The treatment of constipation in pregnancy should be as simple and mild as will produce a satisfactory action of the bowels, and can be accomplished by including in the diet fruits such as plantains, figs, prunes, papaya etc. course and fibrous vegetables and abundance of fluids such as milk, butter milk and warm water. Cocoa and coffee or tea are also useful, but cocoa constipates in some cases and much of tea and coffee do especially produce sleeplessness and "bilious" attacks in peculiarly susceptible women. Brown bread is a better food than white bread. Crushed oats or Ragi in some form or other is a good laxative and supplies Fe, Ca and vitamins and good proportion of proteins, carbohydrates and fat. Agar in combination with mineral oil—Petrolagar, agarol etc.—are recommended. Strong purgatives are not advised. Castor oil, which is a favourite with many of our people has now been replaced by the agar and

mineral oil combinations mentioned above. Cascara (Aromatic or Elixir) and senna are also good. Many a time combined with constipation there may be hyper-acidity of the stomach, which condition is best treated with Milk of Magnesia taken in small amounts after each meal.

Deposition of pigment is one of the most constant phenomena and is more pronounced in people of darker complexion. We have mentioned that the nipple becomes darkened and that the areola becomes larger and of deeper colour. Intense pigmentation of the skin over the labia majora (two vertical folds one on either side of the entrance into the vagina) and adjacent parts of the vulva is commonly observed; a thin line of brownish discolouration extends vertically along the abdomen in the midline.

Often copper-coloured patches of discolouration (chloasma) are seen in the neck and the face. Itching of the skin especially of the breasts and the abdominal wall is common due to stretching of the skin from distension or dropsy. Itching of the vulva and the perineum near the anus is often present and is due to the presence of dropsy of the parts from congestion of pregnancy. A concentrated urine or a urine containing sugar often causes severe itching of the parts known as "pruritus."

During pregnancy the nervous system is not free from the functional disorders which may be present ordinarily in a person before the advent of pregnancy; but the personal habits and reactions of almost every person are altered to some extent, and hysterical states are then common enough.

Hysterical coditions, it must be remembered, are often feigned by clever women with the object of inducing the medical attendent to remove the presumably offending cause.

Caprices of appetite, vascillation of tastes in general and an unusual degree of nervous fatigue may be exhibited.

1. Signs and Symptoms of Pregnancy

A thorough familiarity with the effects of pregnancy upon the maternal organism as outlined above might serve for the recognition of pregnancy. In a large majority of cases the

patient makes her own diagnosis. An early and dependable diagnosis is desirable in every case so that the woman might make the necessary preparations and adaptations to the new responsibilities involved. In certain cases for example, where the question of marriage hangs upon the diagnosis an early and accurate statement becomes urgent. Yet the medical attendant must care for his own reputation and withhold a dogmatic opinion until the diagnosis is correct beyond doubt. The unpleasant results that may arise from a mistaken diagnosis of pregnancy for the patient and her friends and relatives must make us pay proper attention to this point.

The various signs and symptoms of pregnancy are:

A. The **subjective** symptoms, of which the patient herself acquaints us. They are, (1) **suppression of menses** (or Amenorrhoea). As a rule the first thing that suggests to a woman that she is pregnant is this change. Of course suppression of menses may also result from anaemia, tuberculosis and ovarian disease; but if the condition occurs in a married woman in other wise good health who has been menstruating regularly, and if the stated period of amenorrhoea corresponds with the size of the uterus and with the other results of physical examination, amenorrhoea has a diagnostic value. Otherwise its value is small. It must be remembered that in rare cases even after conception has taken place the woman may continue to menstruate once or twice.

(2) **Quickening.** This is the sensation the woman experiences when she detects the movements of the foetus for the first time during pregnancy. This sensation is comparable to the fluttering movement of a small bird when held in the hand. Such a sensation, however, can readily be simulated by other causes such as movements of the flatus or wind in the bowels; or it is possible that the foetal movements may for some time pass entirely unnoticed by the patient until they become marked. Quickening generally occurs about the 18th week of pregnancy; the period at which it occurs is however, not a **fixed period.**

(3) **Morning Sickness.** Nausea and slight vomiting are common early signs of pregnancy occurring during the first four

months of pregnancy on waking in the morning. As a rule it begins with the II month and continues to the end of the IV month. If morning sickness occurs in a married healthy woman it is a good proof of pregnancy.

These are the most important subjective symptoms occurring in almost all cases of pregnancy. Some women get salivation (water-brash), while others develop a capricious appetite for charcoal, lime, ashes, soap, etc as a result of pregnancy.

B. Objective Signs. (1) *The Face.*—Deposit of pigmentation occurs especially at the sides of the nose and under the Eyes. Such pigmentation is not of much diagnostic value.

(2) *The Breasts.* The common relation that exists between the breasts and the organs of generation is so close that early indications of pregnancy are naturally seen in the former.

The various changes occurring in the breasts as a result of pregnancy are, as we mentioned above, their enlargement with increased firmness, which may be appreciated by the woman herself, or found out by the physician within the first two or three months of conception; from that time onwards the breasts become progressively larger and more knotty to the feel. Both these changes are very constant in pregnancy, but are not quite diagnostic of that condition as they may be present in tumours (new growths) of the uterus and the ovaries. But accompanying the enlargement of the breasts there is an enlargement of the superficial veins giving the breasts in fair women a somewhat marbled appearance. This condition, however, is present only in pregnancy and not in the case of ovarian or uterine tumours.

A characteristic change occurring in the areola constantly and early in pregnancy is, we have seen, the enlargement of the Montgomery's tubercles and a gradual deepening in colour of the pigment contained within the areola and a widening of the areola itself (secondary areola). Preparation for the secretion of milk is made by Nature long before delivery, and from the III month onwards it is usually possible to squeeze out a drop of clear mucoid fluid, which in the last 3 or 4 months of pregnancy contains numerous colostrum corpuscles.

(3) *The Abdomen.* The symmetrical and progressive enlargement of the abdomen can be observed even from the middle of the IV month to the end of the IX, and during the X month the level of the fundus of the uterus is the same as in the VIII month. There is commonly a well marked brownish line running from the umbilicus to the symphisis pubes and increased pigmentation in the neighbourhood of the groins; so also striae gravidarum; very often especially during the last 3 or 4 months of pregnancy the movements of the foetus could be seen.

Palpation (feeling with the hand) reveals a medially situated enlarged uterus, its height corresponding to the period of pregnancy. Its contents are more or less fluid but from the IV month onwards the foetus can be felt and its movements. The enlarged uterus is constantly felt to contract, but the contractions until the onset of actual labour pains, are not painful. Auscultation (listening) with the stethoscope reveals the foetal heart-sounds, which can be heard from as early as the Vth month.

In the period of pregnancy from the beginning of the IV to the end of the V month the presence of a movable solid body in fluid contained inside the uterine cavity can be determined by movement of the fingers known as "ballottement" (meaning tossing like a ball). This is a positive sign of pregnancy.

2. The Hygiene of Pregnancy

Although pregnancy is, as we said, a normal function and while many a pregnant woman may derive benefit from some harmonious relationship between herself and the unborn babe it may be said that pregnancy is also a period of stress and strain and that but few women pass through it without more or less functional or even organic disturbances. By judicious and timely advice, therefore, regarding the details of hygiene of pregnancy which can be done to obviate such disturbances and prevent them from developing and constituting a serious menace to health. Luckily most of our pregnant women especially the educated classes do really take an intelligent interest in their welfare, particularly regarding diet and general hygiene, and as a rule all women do naturally develop during pregnancy a

peculiar form of receptive mind, so much so whatever advice their medical attendant may give them regarding their condition of pregnancy is meticulously followed by them; and women who have hitherto paid little attention to the common Rules of Hygiene do, during pregnancy with a little judicious guidance form habits of general cleanliness, habits of sleeping with windows wide open, of eating good food, taking care of their teeth etc. These habits formed during pregnancy may, however, be continued to their benefit throughout the rest of their life-time.

Owing to its concern with the start of a new generation the hygiene of pregnancy holds a key-position in all our efforts to promote national health and national stamina and secures the maximum number of new lives at the minimum cost in loss or damage to the mothers, and to give a fair start to those new lives.

Diet

Physiologists universally agree that the diet of the pregnant mother has no influence whatsoever on the child's weight and that there is no correlation between the weight of the child and the gain in weight by the mother; but, there is no doubt that a generous diet in pregnancy increases the probability of a successful lactation after delivery. Hence it may be said that provided the diet is already a generous one no modification of its quantity is necessary in pregnancy.

It is important that the expectant mother should not indulge in every caprice of appetite, commonly showing itself in the pregnant state; but eat sensibly keeping up her strength for the ensuing act of confinement and yet avoiding overloading the stomach and throwing too much strain on the liver and the kidneys.

The common impression that the pregnant woman has to "eat for two" is utterly fallacious and leads to over-eating. To over-eat at the critical time is extremely unwise, for it brings on a kind of self-poisoning on account of the inability of certain organs of the body to work in the normal manner. Overeating also produces flatulence and colicky pains in the stomach, which are apt to be mistaken for labour-pains or threatened

miscarriage and lead to unnecessary alarm to both the woman and the household.

Overeating even in a normal person is harmful, why then should a pregnant woman over-eat, when she has every reason to be careful about herself?

Now, a generous diet, we have seen, is one which includes not only proteins, carbohydrates and fats, but should contain a proper provision of mineral salts, especially of Ca, P, Fe and Iodine and of vitamins. Necessary as all these ingredients are in the diet of an ordinary adult, they are much more so in that of the pregnant mother, who has to provide not only for her own daily needs but also for the needs of the **rapidly** growing and developing foetus within her.

An increase in the proportion of proteins is advisable during pregnancy and period of lactation. The increase is required chiefly to provide for the needs of the growing foetus and for the growth of the muscular structure of the womb. Atleast one half of this amount should be 'suitable' proteins, as of milk, eggs, meat, these proteins having a high biological value as we have seen.

There is no evidence that a high protein in-take is harmful, though it is possible that it makes necessary an increased consumption of vit. B and D.

Calcium and Phosphorus. Milk is the richest source of Ca and P. They are present in milk in the most suitable form to ensure assimilation and retention. Other important sources of Ca are oatmeal, bran, dhall, fruits, vegetables and green leaves; C and P may of course be supplied in the form of soluble salts, as the calcium lactate, but it is better to give it in its **'natural'** form, that is; as it exists in our foods, as the foods contain other valuable factors also in addition. Foods rich in P are milk or its products (butter milk and cheese), eggs, meat, liver, fish, whole wheat, ragi, oatmeal, soya beans and other legumes, spinach, Brussels sprouts and potatoes.

Effects of Ca and P Deficiency on the Offspring. There is conclusive experimental and clinical evidence to show that a Ca and P deficiency in the diet of pregnant women or a deficiency

of either, predisposes the child to rickets; and in cases of extreme deficiency rickets may even be present at birth. But it is more common to find that the child is born with an inherited tendency to rickets, which is not always capable of being overcome even by a period of well-dieting of the child after birth; or, the condition may become evident again at a later period of defective feeding. Rickety changes in the offspring can also be induced by feeding the mother on a diet deficient in anti-rachitic vit. D and Ca.

A second effect of Ca and P deficiency is defective calcification of the teeth in the child, leading to their caries after dentition. It is said that while a predisposition to rickets may be overcome by good feeding after birth the defects of the teeth cannot be so overcome. Breast-milk may be deficient in Ca, hence, rickets may develop even in the breast-fed infants; but if the mother should be fed on diet rich in Ca, the Ca-content of the breast-milk may improve considerably.

Effects of Ca and P Deficiency on the Mother. If there is very marked and prolonged deficiency, especially if it is continued throughout several rapidly succeeding pregnancies, ostomalacia (adult rickets resulting in softening of the bones) and extreme bony and pelvic deformity. The condition effects both men and women, but pregnant women are specially prone to it and in them it often progresses rapidly. Green Armytage of Calcutta is of opinion that it is produced by deficiency of Ca, P and vit. D aggravated by lack of sunshine. The foetus in such cases may suffer from rickets and defective formation of the teeth. The condition can be prevented or arrested by the administration of Ca salts (or milk which contains it in suitable form and proportion) and Cod Liver Oil.

Certain other disturbances of pregnancy have been attributed to Ca deficiency, such as cramps, vomiting of pregnancy and even uterine inertia and Post-Partum-Haemorrhage (P. P. H.) (flooding after delivery).

Iron. Pregnant women are particularly prone to anaemia. This is largely due to the demands of the foetus for Iron. The liver of the newborn child contains weight for weight nearly 5 times

as much Iron as the liver of the adult. As the Iron-content of milk is poor this is no doubt a provision for the early months of life after birth. The store of Iron is laid down chiefly in the last 3 months of pregnancy, and it is therefore then that anaemia is liable to become most marked. Hence an adequate supply of foods rich in Iron is necessary at this time, such as Eggs, Liver, kidney and lean meat, fruits like peaches, apricots, prunes etc., green leafy vegetables, particularly amaranthus, spinach, tomatoes, turnip tops; fish and cereals are poor in Iron, but unmilled cereals do contain a certain amount.

Iodine. The use of seafish and seasalt during pregnancy and lactation or of Cod Liver Oil is recommended.

Vitamin Requirements—Vit. A. (Growth and Antiinfective) is required for growth and increasing the resistance to infection. Deficiency in vit.A leads to night-blindness and Xerosis. In mothers whose diet during pregnancy had been deficient in vit.A, it is said that catarrhal conditions of the respiratory tract, such as Bronchitis, Pneumonia etc. are more frequent in the offspring. This vitamin is contained in milk, butter, cream and cheese, especially if the cows are grass-fed, and in green leafy vegetables such as spinach, lettuce, brussels-sprouts, cabbages, green-peas and amaranthus; and among the root-vegetables, carrots and yellow sweet potatoes; while white potatoes, turnips, radishes, beet-root and onions contain very little. Fruits, such as tomatoes, bananas and dates contain as much as green vegetables. Papayas, mangoes, apples, figs, oranges and lemons, grape-fruits and pine-apples have small but appreciable amounts. Lean-meat contains little, but liver is very rich in it (200 times as much as muscle). Cod Liver Oil and other fish oils are extremely rich sources of vit. A. It is usually absent in lard and Vegetable oils, except the red-palm oil.

Regarding the anti-infection power of vit. A we shall remind the reader of the following observations of McCarrison: 'Fertility,' the course of pregnancy, of labour, resistance to infection following labour, and lactation are all **adversely** affected by defective dietary; still birth and maternal mortality are also some of the results of defective dietary. (See page 153).

Vit. B is chiefly contained in wheat and rice germ; yeast is the richest source of it known, potatoes contain comparatively little; and carrots, lentils, beans, peas, egg, liver, green leafy vegetables do contain less. Milk, meat and fish are poor. White-flour does not contain any vit. B in it. This is one reason why brown and whole-meal bread is preferred to white bread.

Deficiency in vit. B_1. As in the case of all adults, in pregnancy vit. B_1 deficiency leads to Beriberi in the endemic areas, multiple neuritis and possibly to constipation. It is conceivable that it plays a part in the causation of other lesions or disorders that are dependent on atony of unstriped muscle, or on its defective innervation, such as Uterine Inertia during labour and post-partum haemorrhage after delivery.

Deficiency in vit. B_2 (Antidermatitis vitamin), leads to pellagra. In pregnancy some forms of anaemia are caused by the deficiency of vit. B_1 and B_2.

Vit. C. (Antiscorbutic) is present chiefly in green leaves such as cabbages, lettuce, cress, potatoes and fresh fruits especially the citrus group—oranges, lemons, grape-fruits, cashew-fruits, papayas. Milk is a valuable but by no means a rich source of it. Vit. C is largely destroyed by boiling, but potatoes retain a fair amount of it even after boiling. Tinned tomatoes do retain a certain amount of vit. C.

Deficiency in vit. C in diet in pregnancy may lead to abortion and manifestation of scurvy; dropsy is a common result. The child may be born with scurvy. Severe anaemia may lead to Accidental Haemorrhage and even P. P. H. and Uterine Inertia.

One large orange daily or one or two ounces of orange juice daily is sufficient for the needs of the pregnant woman.

Vit. D. (Calcifying and Antirachitic) has the important function of controlling the deposition of Ca and P in the tissues especially bones. Vit. D is not stored in the body. The body should therefore depend on outside sources for its supply, though a certain amount of vit. D is formed in the skin by exposure to sunlight.

Eggs especially the yolk, Cod-liver and other fish oils are rich; milk, cream, cheese and butter contain in small but

variable amounts. The milk of grass-fed cows contains more than that of stall-fed cows. A Teaspoonful of Cod Liver Oil has as much of vit D as a pint of fresh milk, but the contents of milk is much increased by irradiation. Green salads and vegetables contain appreciable quantity but only when fresh. We have seen that vit. D is formed in the skin by exposure to sunshine. Exposure of the naked body can. therefore, make up for deficiency in vit.D in the diet. Where sunshine is lacking a greater provision of vit. D in the form of Cod Liver Oil is essential both in pregnancy and infancy and childhood.

Deficiency of vit. D. Although caries of teeth and rickets in the offspring may be developed if the mother had not received an adequate amount of vit. D during pregnancy and lactaion, yet it is not claimed that even an adequate amount of vit. D and Ca in pregnancy and lactation is enough in itself to ensure freedom from rickets and dental caries in the growing children. It is also necessary to give the child Cod Liver Oil and at least a pint of milk daily throughout the years of growth and adolescence. Hereditary influences too probably play a part.

Summary. 1. Provided that the diet has been a generous one (i. e. well-balanced with the proper amount of Proteins, Carbohydrates, Fats, vit. and salts) no appreciable increase in its quantity is necessary in pregnancy. It is unnecessary for her to make any drastic change in her dietary or habits provided that moderation is practised. Snacks and nibbles between meals should be sternly discouraged. This is a weakness of the female sex at any time and is to be deprecated as it brings on all sorts of digestive disturbances.

2. Atleast half the protein should come from animal sources, viz. milk, eggs and meat (liver).

3. Care should be taken that sufficient Ca and P are provided for the proper formation of the foetal bones and teeth. The best source of these is milk, of which it is recommended atleast 2 pints should be taken daily, either itself or as curds; other important sources of Ca and P are eggs, oatmeal, ragi, fruits and vegetables. These supply Fe also.

4. To provide the small quantity of Iodine necessary seafish should be taken twice a week. Fish liver oil also contains it in large quantities and is a good substitute if taken daily.

5. The diet should contain a plentiful supply of all the vitamins. To ensure this there should be eaten daily fresh green vegetables and salads including lettuce, spinach, cabbages, Brussells sprouts or green peas, tomatoes, carrots, potatoes, fresh ripe fruits and dairy products, eggs, milk, butter and cheese. **Liver** should be eaten once weekly.

6. Because of the prevalence of rickets and dental caries vit. D is probably by far the most important of all the vitamins in pregnancy and lactation, for, it is needed to ensure the utilisation of the Ca and P and their deposition in the developing bone and teeth of the foetus. Its distribution in foodstuffs is very limited, for only egg-yolk contains any considerable amount of it. It is advisable therefore, to give 2 Teaspoonfuls of Cod Liver Oil or an equivalent quantity of some other fish-liver-oil daily.

7. About 2 or 3 pints of water should be drunk daily preferably slightly warmed or as fruit lemonade.

8. The diet should contain sufficient roughage to prevent constipation. In addition to that in fruits, vegetables and meat, whole meal bread and oatmeal porridge, ragi, green gram eaten with milk are useful and effective.

For making a selection the following is a list of suitable articles of diet.

Meats. Beef, mutton and lamb in moderation and not more than once daily; bacon, seafish, chicken and games. Liver is a valuable addition to the diet. As a rule pork, veal are better avoided being indigestible. Fried meats and fried fish are liable to cause acidity (heart burn) and are better avoided as far as possible.

Soups and Meat Extracts (such as beeftea, chicken soup or other beefjuice preparations). These have no direct value as food, but stimulate appetite because of their pleasant flavour. They may therefore be taken in moderation, but, it should be remembered that they contain extractives, which if taken in excess may be harmful.

Vegetables. Potatoes, turnips, carrots, cabbages, spinach, beetroot, peas, beans, tomatoes may usually be eaten with safety; but Brussels-sprouts, cauliflowers, cucumber, parsnips and radishes should be partaken of with 'moderation and should be well-cooked preferably by steaming rather than by boiling, as otherwise they are liable to upset digestion

Fruits. Apples, mangoes, papayas, plantains, oranges, peaches, apricots, pears, plums, prunes, straw berries, rasp berries, currants, cherries, figs, grapes, pine apples and grape fruits. Some of these should be eaten daily. In addition to supplying necessary accessory food factors they act as gentle and natural laxatives. This laxative action is more marked if fruits are taken as dessert rather than as part of the meal, and if eaten raw, though if preferred they may be stewed.

Bread. Fresh bread, pastry and cake should be avoided as far as possible; wholemeal or brown bread is better than white bread.

Cereals. Oatmeal or Ragi porridge is valuable as a food, and especially if eaten at breakfast helps to maintain regular action of the bowels. It should be well boiled and eaten with plenty of milk.

Rice, sago, tapioca, arrowroot and custards are in moderation harmless and are easily digested. Their anticalcifying action should be borne in mind and they should be taken with milk.

Milk, eggs, butter and cheese are excellent wholesome and harmless foods. The first of these especially should always enter generally into the diet of every pregnant woman. At least 2 pints of milk and one egg should be taken daily.

Fluids should be taken to the extent of about 2 pints daily and between meals or before break-fast. Plain water is probably best of all, or if this is too tasteless for constant use there is no objection to orangeade or lemonade, barley water or any of the mildly aperient alkaline waters such as apenta water.

Tea and coffee should be taken in moderation, and if sleeplessness is at all troublesome they should never be taken late in the evening or at night, cocoa or hot milk being as a rule much

better at this time. Alcohol is better avoided altogether unless it is specially indicated.

As a general guide to diet in pregnancy and lactation Mellanby states that it should include the following:

2 pints of milk daily, one or two substantial servings of green vegetables, cabbages, spinach or lettuce daily; one or two eggs or egg yolks daily, an apple or orange or some fresh fruit daily, sea fish twice or more a week, calf's liver once a week.

If Cod Liver Oil can be taken two teaspoonfuls daily are advisable. Hallibut-Liver-Oil is equally good and has the advantage that it is smaller in bulk and can therefore be taken in capsules, each of which contains 2 minims. The rest of the diet can be made up as the woman wishes.

Fatty, greasy and fried foods, pastry and sweet cakes etc. should be avoided as they often give rise to acidity or heart burn.

No drinks should be taken with meals, but only 2 or 3 hours later.

In certain disorders of pregnancy, such as vomiting, toxaemic states, established obesity, dropsy and obstinate constipation, dietary regulation constitutes the basis of treatment; and a woman who lives rationally need never have the morning sickness so constantly present in pregnancy and will be free from stomach irritation and other distressing symptoms such as "liverishness."

The following is the dietary schedule for the pregnant and nursing woman as recommended by the Technical Commission of the Health Committee of the League of Nations, Geneva in 1935.

A. Protective Foods

Milk	1000 grms.	(32 oz.)	Containing Ca, P, Fe, Iodine, and vit. A, B_1 and B_2
Meat	120 ,,	(4 oz.)	P, Fe
Egg (one)	50 ,,	($1\frac{3}{4}$ oz.)	P, Fe, vit. A, B_1 and B_2
Cheese	30 ,,	(1 oz.)	Ca, P, Fe, vit. A and B_2
Green leafy vegetables	100 ,,	(3 oz.)	Ca, Fe, vit. A, B_1 and C
Potatoes	250 ,,	(8 oz.)	,, P, Fe, vit. B_1 and C

Legumens(dried)	10 grms. (1¼ oz.)	Containing	Fe and vit. B_1
Cod liver oil	3.5 ,, (1 dram)	,,	Iodine, vit. A and D.
Fresh fruits and vegetables	... ...	,,	vit. C in large amount.
			Total Calorific value = 1460

B. Energy Yielding Foods

Cereals (whole grain, moderately milled) 250 grms. (8 ounces) yielding P, Fe in good quantity and vit. B_1

Total calorific value 1000

The total calories yielded by the above diet is 2460.

Exercise

Women of the labouring class who work in the open air throughout pregnancy are able to pass through their confinements with greater ease than those who lead sedentary lives; it is therefore reasonable to expect that women who spend a great part of the day in bed will be ill prepared for the severe muscular effort required in labour.

Regular exercise in the open air is therefore important for the pregnant woman and should be of the character one is accustomed. It promotes sleep, helps digestion, keeps the muscles in a healthy tone and encourages a cheerful frame of mind. Most expectant mothers get a fair amount of exercise in looking after their homes, but this though often tiring is scarcely the best form of exercise, and an effort should be made to spend at least an hour or two in the open air. All violent exercises such as tennis, riding, cycling or swimming should be avoided during the last six months. Speaking generally the amount of exercise should be regulated by the woman's own feelings and should always stop short of fatigue. There is no reason why house duties should not be continued till the end of pregnancy, provided the rule regarding over fatigue is observed; but women employed in factories should give up their work at least 6 weeks before term, so that they may get more intervals for rest and time for outdoor exercise. Frequent change of activity and relaxation from the mere routine phases of living are an excellent tonic,

Violent physical efforts and extraordinary types of bodily strain are attended with an appreciable risk of miscarriage or premature labour.

Rest and Sleep

While exercise is important a proper amount of rest is even more so, in fact rest is perhaps the most valuable agent in the practice of medicine, and the prenatal period being one of preventive treatment a generous amount of rest fortifies the body against the strain of pregnancy and labour, increases the resistance to infection, prevents toxaemia and gives promise of greater success in nursing the child.

Especially during the latter half of pregnancy at least 2 or 3 hours should be given every afternoon to rest on a couch or bed and if possible in a quiet room; the feet should be raised to the same level as the body and all tight clothing loosened. Towards the end of pregnancy rest periods will have to be more frequent.

Sleep. There should be atleast 8 hours sleep every night in an airy room with open windows. The bed clothes should be as light as is capable with warmth. If possible she should have a room herself.

Labour is often described as the hardest muscular effort a woman is likely to perform, and it is but reasonable that preparation and training for this ordeal would help her to make the most of her powers, to conserve her energy and avoid fatigue by relaxation and rest when action is not required.

Rest should include mental rest as well and pregnancy should be made as pleasant an experience as possible, so that the woman's safety and comfort are not interfered with thereby. (See Mental Hygiene of the pregnant woman—later).

Baths

Regular bathing in addition to its hygienic advantages has a tonic effect and promotes a sense of well-being especially if followed by a brisk rub-down. Massage of the abdomen should especially be avoided in pregnancy.

In the last two months of pregnancy a daily wash-down is to be preferred to the tub-bath, as with the latter there is some danger of the bath-water getting into the vagina where it might be a potent source of puerperal sepsis. Sea-bathing may be indulged in during the early months, unless there is some reason to forbid it, but in the last half of pregnancy it is unsafe.

Travel

Speaking generally, travelling is safe during the first half of pregnancy, but in the later months it should be as much restricted as possible and always at the time corresponding to the monthly periods. Sometimes journeys cannot be avoided, but every woman must be a law unto herself with regard to them. Long journeys are however, not advisable in the last four weeks of pregnancy, nor at any time if there has been a tendency to miscarriage. So much depends upon the degree of comfort with which the journey can be completed, and on the special peculiarities of each patient that it is not possible to lay down more than general rules.

Care of the Teeth

Regular cleaning of teeth important at all times in maintaining perfect health, is especially so in pregnancy. Their cleaning at least twice daily should be enjoined, but better still after each meal. A good cleansing material is Prepared chalk or even Bicarbonate of soda. Teeth that are decayed should be filled or pulled out at once. The importance of diet in the preservation of the teeth has been previously referred to.

Care of the Breasts

Preparation of the breasts for suckling should begin about the 6th month. If the nipples are flat they should be drawn out by the finger and thumb for a short time each day. The nipples too should be kept clean by daily washing them with soap and warm water to get rid of the crusts of dried secretion that tend to form on them. If towards the end of pregnancy the breasts feel uncomfortably heavy they may be supported by a sling, but

they should never be tightly constricted or subjected to constant pressure by the clothing. Rough manipulations should be avoided as they may result in small lacerations which may become infected.

Care of the Bowels

Constipation. This is probably the most common disorder to which pregnant women are liable and is largely due to taking too little fluid and restricting outdoor exercise. It is of the first importance to secure a free action of the bowels at least once daily; and by far the best time is immediately after breakfast and an attempt, even if it is not always successful, should be made at that time. In fact the successful development of a habit-time for evacuation of the bowels minimises the need for all artificial stimulants.

In the prevention and cure of constipation proper exercise and diet are most important rather than drugs. Taking a sufficiency of fluids, eating fresh fruit, green vegetables, brown-bread, bran-bread, ragi and wheat chapatis and oatmeal porridge at breakfast, and drinking a glass of hot water immediately before or just after rising in the morning are all laxative in their effects, but pieces of hard orange-skin act as a mechanical stimulus to the bowel. The value of figs, dates, prunes is well-known; and a very good home-made remedy is stewed prunes, and to make them more effective it is a useful plan to infuse some senna leaves in a muslinbag and put them into the pan beside the prunes to be stewed. Castor oil is very useful occasionally and has the advantage that it acts quickly. One or two table-spoonfuls may be taken as a dose; but it is not suitable for constant use as it tends to constipate afterwards. Strong purgatives like Epsom salts are contra-indicated, but Siedlitz powder and Fluid Magnesia are less violent.

Urine

The regular action of the eliminatory organs of the body is of very great importance. If the skin, the kidneys and the bowels do not act sufficiently well, the most serious complications of

pregnancy may arise. The pregnant woman should in all cases be warned of the importance of noting a sudden or gradual diminution in the amount of urine which is passed daily. Frequent examination of the urine is therefore essential, as very valuable information may be obtained which may enable us to forestall such dangerous complications, as eclampsia, hyperemesis etc. If the urine is normal, it should be examined atleast once a a month, and if albumen is present it should be examined weekly or even daily. If the kidneys do not act sufficiently the amount of fluid intake such as barley water and plain water should be increased. The action of the skin should be encouraged by hot baths, warm clothes and in some cases by the administration of apenta, apollinaris, saline purgatives like mag. sulph., soda sulph. etc.

Clothing

The amount and kind of clothing depend so much upon climate and season that it is not possible to do more than lay down some general rules. Clothing should be warm enough to guard against chills, sufficiently loose to allow free movements of the limbs and free breathing and should not tightly compress the abdomen or breasts. If corsets have been worn they need not be let off,. but should be so chosen as not to compress but rather support the abdomen and the breasts from below.

In most cases and in all cases where the abdomen is pendulous (hanging forwards) the use of a well-fitting abdominal belt so adjusted as to support the abdomen from below is advisable. Garters must not be worn as they increase the tendency to venous congestion of the legs and dropsy.

Shoes should be comfortable and large enough to allow for the slight dropsy of the ankles and feet which may accompany pregnancy in the later months. They should be reasonably broad, for the centre of gravity undergoes a partial but decisive change throughout pregnancy. Falls are common accidents in pregnancy and are most dangerous and should be avoided. The heel should be broad, of the usual height to which the woman is accustomed. A high heel compels the patient to hyper extend

the back which is already so displaced in an effort to maintain the equilibrium.

Marital Intercourse

It is not usual to abstain from sexual intercourse during pregnancy although in this respect the lower animals set an example to man. Coitus should certainly be avoided after the 6th month, for there is reason to believe that thereby dangerous virulent organisms that might cause puerperal sepsis may be introduced into the vagina. Coitus should be especially avoided in cases of habitual abortion.

3. Influence of Emotion upon Pregnancy and Delivery

The influence of the mind upon the body functions has been examined by physiologists, and certain normal functions which were once considered to be purely mechanical have in the light of modern research been traced to be dependent on certain mental states and emotions like fright, anxiety etc. Now pregnancy and delivery are normal functions and are dependent to a certain extent on mental emotions of fright and anxiety.

Normally there exists a harmony between the nervous system and muscular action, so that in the performance of any natural function a given stimulus produces an adequate result **unattended** by pain or by shock.

The human race has, however, been rapidly drawn into the whirl of civilisation and culture, and time, space and environment have demanded a re-adjustment of mental activities out of all proportion to any physical evolutionary change that has taken place. The relative harmony or balance between the higher nervous centres and muscular reaction is thus upset, and this imbalance forms possibly the cause of many of our ailments to-day.

Now, labour in a modern woman is a natural function, but it is attended by considerable pain and possibly danger. Nature, however never intended that reproduction should be painful and there is no evidence either that in the evolution of the

human body the uterus during normal labour was expected to give rise to pain. Then, why is there a greater tendency for pain to occur during labour in cultured women than there is in the uncultured or more primitive races? There is no evidence that the relative size of the foetal head to the maternal pelvis increases with the advance of culture and there is no evidence either that the uterine muscle of the primitive is in any way stronger and more efficient than the uterine muscle of the cultured; and even supposing that the skeletal muscles (limb muscles) of the primitive woman are stronger, they are never brought into play during normal delivery until after the stage at which the cultured woman usually experiences most of the pain.

The cause of pain, then, in the cultured woman must depend on some change other than physical, and since culture itself is primarily the development of mental activities it is reasonable to infer that to a large extent the pain of labour is consequent upon a similar development—possibly it is the high nervous tension engendered by the stress and strain of modern civilisation.

Now, nervous tension or simply nervousness is always accompanied by the emotion of fear, and it is from fear that labour has so justly earned the reputation of being an "agonising" process, as fear disorganises the nervo-muscular balance or harmony above referred to.

There is in addition often the common tendency of friends and relatives or even the mother to warn the pregnant girl of the terror with which she is about to be faced. Contractions of the uterus are in common parlour known as labour pains; and the teaching of the religion of the Christians adds weight of apparent fact to the mental and physical horrors of child-birth in the case of a high-strung individual.

Now the emotions of normal labour as are observed in primitive women appear to be of two kinds: (1) the parental interest and its accompanying emotion of tenderness and (2) the instinct of self assertion, which gives rise to the emotion of elation, which is shown by the happiness of the woman about to bring forth her child; so much so that delivery is never consi-

dered among them a serious affair. In fact in them delivery is not more complicated a physiological process than the normal act of defoecation; and in fact the whole atmosphere in their case is one of pride and tenderness and not of fear or anxiety; and what in the cultured woman might appear to be agonising pain, it is in the primitive woman at most a hard work; discomfort there may possibly be but pain is considered of minor importance.

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Before we proceed to deal with the important subject of Mental Hygiene of the Expectant Mother and its connection with the physical, mental and moral efficiency and development of the future issue it is desirable that she should know something about the influence of heredity on the offspring. Such a knowledge, however, will enable her to so regulate her life during pregnancy as to produce the most beneficial results on the coming child,

4. Influence of Heredity on the Offspring

The influence of heredity on the offspring has long been recognised, and it is a truism to say "what is bred in the bone comes out in the flesh." A child is born with certain tendencies inherited from a line of forebears, and how he turns up in after-life depends to a large extent on whether these tendencies are suppressed or allowed to develop. A drunkard may breed drunkards, or a criminal criminals; but the environments into which the offspring is placed and the training and education he receives in early life may prevent the evil tendencies from germinating in him.

Suppose the child of a professional burglar were taken away immediately after birth and placed in a good house under moral influences he would in all probability turn out, when he grows up, a respectable and useful member of the Society. Nevertheless the parental tendencies may sometimes present themselves inspite of the change of surroundings and circumstances. Henry Irwing, it is said, trained his sons for the professions, yet they all abandoned those professions in favour of the stage, the fever for acting ran in their blood, as the common saying is.

Certain taints are hereditary and are transmitted to the offspring. For instance, Alcoholism, Insanity and Epilepsy. But the tendencies can be corrected or completely checked; or they can be developed or encouraged, and the son follows the parent "to the drunkard's grave" or the Mental Asylum.

Many misconceptions are, however, abroad regarding the influence of heredity. It is often asked, for example, if tuberculosis is inheritable. It is quite illogical to suppose that the germs of tuberculosis are passed on from one generation to another; but the son of a tuberculous father may be physically adapted for tuberculosis, and it depends upon habits and environment whether the disease attacks him. We say "attacks" advisedly, for the disease is not and obviously cannot be born with the child; and the conception is biologically unsound also. When a child "adapted" for tuberculosis lives with sufferers from the disease and perhaps follows the same occupation as his tuberculous father and runs the same risks it is obvious that the child may contract the disease himself.

Physical defects acquired during life are not heritable. It is said that during the Great War there was a scare, born of ignorance of the Natural Laws of heredity, that the children born of maimed fathers will inherit their defects. There were at that time a large number of young bachelors who wished to marry, and stupid people began to spread this rediculous notion; naturally, it caused a good deal of unhappiness among the credulous and unthinking, but the notion is wholly absurd.

Neurotic conditions of the parents are often transmitted to the offspring and follow what is known as the Mendelian Law: (1) If both parents are neuropathic or suffering from some form of nervous disease the children will be neuropathic or liable to develop one or another form of nervousness. (2) If both parents are normal all the children will be normal and not capable of transmitting any neuropathic tendency to their progeny. (3) But if one parent is normal and the other neuropathic all children will be normal, but capable of transmitting the neuropathic tendency to their progeny.

Neuropathic states, however, do yield to treatment, and as

most nervous states are produced by suggestion or imagination itself, treatment by suggestion also effects a cure, as "like cures like." Good habits, both of living and thinking are the best safeguards in the future life of the child; and parents should see that such habits are contracted by them, as apathy or ignorance on the part of the parents have often resulted in the ruin of many a young life. Such people, of course are not fit to become parents; they look upon their children as an expensive nuisance and the progeny are neglected in consequence. We know examples of myopic children being allowed to strain their already weak eyes by not being provided with suitable glasses. What we say is that parents also need education as much as the children themselves.

There is the other class of parents, however, who hold that too much care of the fussy kind is not good for children. Children taken too much notice of grow up with the wrong kind of equipment for the battle of life and are liable to get nasty shocks when they get into the world.

5. Mental Hygiene of the Pregnant Woman

"Too many babies," says Webb-Johnson, "start life handicapped unfairly because their mothers have been unfair to themselves during the period of pregnancy." It is fortunate that of late prenatal clinics have come into existence, where expectant mothers are given instructions regarding the care about themselves and the coming child. If mothers desire for healthy children they must lead healthy lives. Yet we see pregnant women being in a tense atmosphere of excitement, eating unsuitable food and being indiscreet in so many ways, sitting up late at night, wearing their nerves to shreds and generally behaving in ways best calculated to give them a neurotic and sickly child. Some women all through the pregnancy are in a chronic state of auto-intoxication by food poisoning, that is to say, that the waste products of food are poisoning them. This condition causes a state of nervous irritability, and children born in these circumstances will not be happy and healthy. Mothers, who during the critical period just before child-birth do not lead

healthy, sensible normal lives cannot expect to have healthy sensible normal children.

Miscarriages and premature confinements are due to excitement often of a sexual character. A mother should be allowed to forget about the sexual life, while in the pregnant condition; but ignorant and selfish husbands do not either realise this, or do not care if they do.

In respect of sexual intercourse after conception has taken place in the female man has to learn from the lower animals. The female animal will not allow access to the male except during the "rut" and never after conception has taken place; and if this analogy of the lower animals and many savage races is to be followed coitus should be entirely forbidden even from the earliest months of pregnancy.

There are other excitements which the pregnant woman should avoid, such as the excitement of family quarrels. Sometimes women grow peevish and irritable particularly during pregnancy, and work off their nerve tension by picking silly quarrels for trifling reasons. This is highly injurious to the baby in the womb and must be avoided.

Some women are so afraid of missing social functions that they continue to go to parties and on visits to friends until they are near confinement. This kind of excitement saps the nervous energies; and in fact any sort of excitement is bad both for the pregnant mother and her coming child. Hence any style of living that affects the mental and physical health of the mother adversely should be avoided; for it is certain to leave its imprint on the child. The idea must be to "build up" not "pull down," and undue excitement and wrong modes of life are destructive.

The Husband's Duties during the Pregnancy of his Wife

It is important that the husband should consider his wife and her health not only sexually but in other ways. He should refrain from exciting her by quarrelling or persistently finding fault with her, nor should he insist, as some husbands do, on her

accompanying him to pleasure parties and merry making.

A National Baby-Week pamphlet says: "If there be a clinic for expectant mothers it might almost be well there should be a school for expectant fathers" and suggests that the expectant father should take his wife a cup of drink in the morning **before she leaves her bed**, do all her domestic work, help his wife to look on the bright side of life and not carry his business worries home more than is necessary. He must also look after the other children whenever he can.

We mentioned above that a calm and happy mind free from worry and all disturbing emotions is needed for the woman who wishes to bring a healthy and happy baby into the world. More than anything she should refrain from listening to stories told by the morbid minded and the mischief-making.

The world is full of comforters of all kinds, and those who disturb the peace of mind of prospective mothers are perhaps the vilest among them. They certainly are the devil's own. They make a business of relating every story they ever heard of unfortunate labours to all the pregnant women they can reach. If they read of some one dying or hear of a desperate case of labour, where instruments were used, the child born dead or the mother badly lacerated, or where abscess of the breast and such other unhappy complications of confinement developed, they immediately go to every pregnant woman accessible, tell her all they have heard and speak copiously on their story. They take a devilish delight in creating as much fear and anxiety as they possibly can. These senseless devils are the most despicable creatures on earth and those who tolerate a second visit from them are not much to be pitied. It may be that the evils that they do is wrought more by want of thought than by want of heart; but they do not realise the dreadful harm they might be doing more especially to the young woman expecting her first confinement.

To sum up: The expectant mother should lead a life as tranquil as possible free from all unhealthy excitement, quarrels and other disturbances. It may, of course, be impossible to avoid all worries in this age, but they should try to worry as little as

possible. Women whose husbands are men of only moderate means are apt to worry financially, they dread the additional expense of a confinement and are apt to worry whether the money could be found without difficulty. All these worries, anxieties and fears—the fear for instance of labour—sap the expectant mother's strength and energy and make the outlook bad for both the mother and the child in the womb.

It is perhaps hardly necessary to add that the mother should lead a life free from all excesses; smoking too much and partaking too frequently of alcoholic liqours are to be avoided. Some children are born with an alcoholic taint, because of the indulgences in them by the mother during pregnancy.

It is most important too that the expectant mother should attend to her diet properly, avoiding over-feeding and also eating the wrong kind of food.

II. Antenatal or Prenatal Care

[The Care of the Pregnant Woman before the birth of the Child]

The great contribution of Obstetrics to the field of Preventive Medicine is not generally appreciated. The practice of prenatal care however, along with the development of obstetrics as an independent speciality conducted by broadly trained specialists in well equipped hospitals have been the chief contributing factors in the achievement of a negligible rate of morbidity and mortality for both mother and child.

Prenatal care constitutes professional supervision throughout pregnancy and is intended to accomplish for the expectant mother what periodic health examinations in general do for the public at large.

The advantages of approaching problems from the standpoint of prophylaxis (or prevention) rather than by the treatment of established disorders are too obvious to be explained in detail, and we outline below merely a rational course to be followed by every mother for the proper and safe conduct of her pregnant condition.

It has been remarked by some that prenatal care, as

periodical health examinations in general do, sometimes kindles in nervous people an unwarranted degree of hypochondriasis; that is to say, a neurotic woman may be made so unhappy over a minor variation from the normal that the very object of prenatal service is lost. To this it must be replied that the risk, however is very slight especially with the exercise of a certain amount of tact and understanding in dealing with such cases.

It must be impressed on the pregnant person that pregnancy is a normal function of married life and that it is her right to anticipate good health, and that professional care is indicated on account of the tendency of the pregnant state to develop an increased susceptibility to certain disorders of the system and for timely detection and relief of such disorders, in fact, distress of any kind.

Although most pregnant women enjoy normally good health there are others who suffer variable degrees of organic impairment. Infectious diseases for example, may leave their mark on the kidneys; Tuberculosis, Heart Disease, Anaemia may weaken the system to such an extent that any sudden or unusual stress or strain may render the condition of the mother grave; venereal disease may render the condition of the mother and the foetus in the womb very serious; pelvic deformities may be a problem calling for surgical interference later on if the pregnancy should be allowed to go on to full term.

A wise programme of such foresight fortifies the patient and the medical attendant against the problems of pregnancy and labour, and aids in promoting the smoothness of convalescence with speedier return to normal health and activity.

1. The Benefits of Antenatal Care

They are:

(1) The removal of anxiety and dread from the minds of the expectant, parturient and puerperal patients.

(2) The removal of much discomfort amounting in many cases to suffering.

(3) The early and much more satisfactory treatment which can be given to the dangerous complications of pregnancy, such as, toxaemia, anaemias, syphilis and heart disease.

(4) The increase in the number of normal labours and normal pregnancies.

(5) The still-birth rate is at once lowered.

(6) In Ballantyne's own words:

"One may confidently look for a fall in the maternal death-rate due to such obstetric complications as sepsis, haemorrhage, embolism and the like and to the operative interference which they call for."

2. Hospitalisation

This has several advantages:

(1) **Safety**—With the development generally of hospital facilities for patients of every social status, and with the conveniences of transport the practice of hospitalisation for labour, delivery and early convalescence is rapidly growing in this Country and is a credit to the people and the medical profession, and justifies this practice beyond doubt. It must be remembered that obstetrics is a surgical speciality, and the facilities for securing and maintaining asepsis in the private home are inadequate at best and as a rule they are conspicuously so. It is well known that every woman in labour faces the possibility of operative interference for delivery itself, and the attendant cannot provide the necessary equipment that may be needed urgently and quickly for meeting any emergencies, such as extensive suturing, control of haemorrhage, for the resuscitation of the asphyxiated infant and many other problems which can arise suddenly and unexpectedly. Such emergencies cannot be met adequately except in a well-equipped hospital. Further, it not infrequently happens that Medical, Surgical, X-Ray and other specialised problems arise which call for prompt and dependable consultation. The facilities for such consultation are possibly available only in a hospital. The materials and apparatus for good anaesthesia are always in readiness for use, and as a rule the best anaesthetists are in attendance in such hospitals.

The conduct of labour and delivery becomes a uniform routine, whereby the mind can be concentrated on the problems of the patient and not upon those of the environment, and one can

rely the utmost on the equipment, asepsis and necessary assistance.

(2) **Economy.** It might seem at first sight that hospitalisation is a costly affair and perhaps a luxury as contrasted with delivery at home. But for a comparable degree of convenience and safety at home the cost of alterations, equipment, nurse, attendant, anaesthetist or consultant far excels the average cost of hospitalisation, which with due care and consideration may be brought down to a minimum. People certainly do not hesitate to purchase health and comfort even when unusual risks are not anticipated, and hospitalisation is indeed an inexpensive form of insurance against a high probability of risk.

(3) **Convenience.** The patient is spared any extensive preparation of the house and its disturbance incidental to the process of labour and delivery. If the convalescence takes place at home the mother can never escape the obligation of directing the care of the house and often the other children, whereas the puerperium is an interval requiring abundant rest, both physical and mental, relaxation and freedom from the routine of house-keeping. These matters can usually be consigned to a relative or friend, whereas the work of caring for the convalescent woman is strictly the work of a nurse.

(4) **Nursing Care.** In the hospital this work is done or supervised by specialists so to say, who devote their entire time exclusively to this type of work, who practise modern and accepted methods of treatment under the guidance of experts.

3. Determination of the duration of Pregnancy and the Approximate date of Delivery at Term

When the existence of pregnancy has been ascertained the next consideration is to determine the age of pregnancy with a view to predict the date of delivery. This is always a difficult matter to decide with certainty, and one about which the obstetrician can, and should never, be definite, as it is not possible to say with exactness when pregnancy begins and accordingly when it will end. Hence all that the obstetrician

can do is to fix on an approximate date, and to consider it as the middle of the fortnight during which delivery may take place.

For the determination of the expected date of delivery the classical formula is: From the date of cessation of the last menstrual period count backwards 3 calender months and add 7 days. This usually comes to about 280 days. The date so arrived at indicates the middle of the fortnight within which the delivery can take place. Thus, supposing that the date of cessation of the last menses was the 1st January in any year, then, counting 3 calender months backwards takes us to 1st October, to this add 7 days; the result is 8th Oct. This 8th Oct. only indicates the centre of the fortnight within whtch delivery can take place; in other words, delivery may take place even as early as the 2nd Oct or as late as 15th Oct.

The extreme limits of maturity as recognised by Law are 40 days either side of 280 days, that is 240 and 320 days respectively.

In the above calculation of the date of delivery it is presumed that fecundation or fertilisation of the ovum (of the female) by the spermatozoa of the male is produced on the day of the coitus, which is usually effected after the cessation of the menses. In cases where pregnancy has resulted from a single coitus (where the male had no access to the female after coitus till pregnancy has advanced), the probable date of delivery is also calculated by the above formula.

Another method of calculating the probable date of delivery is by noting the size and height of the uterus. This method enables to fix the probable age of pregnancy also.

At the	II	lunar month ..	the uterus is of the size of an orange
,,	III	,, ...	the uterus is of the size of the foetal head at birth
,,	IV	,, ...	halfway between the symphisis pubes and umbilicus
,,	V	,, ...	2 fingers' breadth below the umbilicus
,,	VI	,, ...	at the umbilicus
,,	VII	,, ...	3 fingers' breadth above umbilicus
,,	VIII	,, ...	midway between umbilicus and the ensiform cartilage

At the IX lunar month ... almost up to the ensiform cartilage
,, X ,, ... same level as at the 8th month

As the uterus reaches approximately the same height at the end of the VIIIth and Xth months it is necessary to be able to distinguish between the two. At the VIIIth month the abdomen is less prominent and is perceptibly smaller than it subsequently becomes at the Xth month. The patient also will say that during the VIIIth month the symptoms caused by pressure of the uterus against the diaphragm are increasing day by day, while during the Xth month the pressure symptoms are decreasing.

4. Preparation for Labour

We have already discussed about the advantages of antenatal care and the advantages of hospitalisation of pregnant women. While an increasing number of our obstetrical patients especially in the Cities are receiving care in hospitals and maternity homes the majority are still confined in their homes particularly in the rural districts. This will probably be true for some time to come. While the facilities available in the private home in regard to equipment, assistance etc. are hardly comparable to those of well-managed institutions, at the same time it is quite possible to so arrange matters in the average home that a normal patient may receive reasonably good care.

In Cities where there are prenatal Clinics the visiting nurses usually issue clear instructions especially to the primiparae in regard to the signs and symptoms by which the onset of labour may be recognised, such as continuous pains, the possible appearance of a "show," or signs of rupture of the membranes etc., so that the patient may send for her midwife at once and in time.

It is certainly most advantageous to procure and get ready the services of a well trained midwife sometime in advance of the expected confinement, who will inspect the quarters to be occupied by the patient in order that the surroundings may be properly arranged. And it should be the midwife's duty to see that articles like clean basins, bed-pan, douche-can etc. are on hand and a proper supply of necessary antiseptics and sterile dressings are ready in the house and drugs.

At the onset of labour the patient should receive a full bath and a soap and warm water enema. An empty rectum facilitates labour, so also an empty bladder. An empty rectum also lessens the likelihood of contamination of the genitals by foecal matter during the actual expulsion of the child.

The use of a vaginal douche before labour and the use of drugs like Ergot and Brandy, which is the common practice to use among our people should be left entirely to the midwife or obstetrician in attendance. We are not in favour of the routine use of Brandy in every case of labour, unless there is an absolute need for it in the opinion of the obstetrician.

III. The Puerperium or the Lying-in State

This is the name applied to the period during which the woman (the puerpera) is recovering from the effects of pregnancy and delivery. Strictly speaking it lasts from the completion of labour until the completion of the uterine involution or the return of the womb to the size of the non-pregnant state, which means about 6 weeks. In common usage, however, the term means the time the woman remains in bed, and is considered to end as soon as the lochial discharge ceases, that is to say, about 10 to 14 days. During this period the maternal organism is recovering from the changes which occurred in it as a result of pregnancy and labour; and the future well-being of the woman demands that this process of repair should be carried out in a normal manner and should be complete.

Involution of the uterus is the most striking phenomenon of the puerperium. Immediately after delivery of the placenta (or the after-birth) the uterus may be felt as a firm ball, extending about 5'' above the pubes due to contractions of its muscular fibres; the true involution process starts with this contraction although it does not become evident for atleast 2 weeks.

The effect of involution of the uterus is, then, to bring about a gradual and marked reduction in its size and weight, and the process can be said to complete in 6 to 8 weeks' time, when the uterus reaches back to the normal dimensions of the non-pregnant state. **The lochia** (which means the discharge belong-

ing to child-birth, the "cleansings" as it is commonly known) is the discharge which comes from the uterus during involution. In a normal case, where there is no infection, it consists from the first of blood, serum and mucus with perhaps shreds of the foetal membranes; later the blood gradually diminishes and finally about the 6th day the blood disappears, and the discharge then consists of a purely serous transudation.

The pulse of the parturient woman is as a rule slower than normal and the temperature may temporarily rise to about 100° on the first day after delivery as a rule in all cases.

The appetite for the first two or three days is usually somewhat diminished but increases later on as the demand made by lactation (secretion of milk by the breasts) increases. Thirst is usually keen at first in consequence of loss of blood during delivery and later as a result of lactation. The bowels are almost always constipated due in part to relaxed abdominal walls and in part to the recumbent position and lack of exercise. Digestive troubles like nausea and vomiting which might have caused considerable annoyance during pregnancy usually disappear with the expulsion of the foetus.

In consequence of the increased action of the skin and the kidneys and disappearance of the dropsy, the involution of the uterus and dimished ingestion of food there is a distinct loss in the weight of the woman during the first 8 or 10 days of delivery. The abdominal walls which were considerably stretched during pregnancy do become flaccid and wrinkled soon after delivery, but the condition passes off in about two months' time and a certain amount of laxity persists after the first pregnancy and the striae gravidarum gradually become fainter

The symptoms of a normal purperium are generally slight especially in the labouring classes, infact as soon as labour is over the woman experiences a sense of relief which is in marked contrast with her former pain-hararssed condition, and during the lying-in period she is in a state of general comfort and well-being, which she had not enjoyed since the last month of pregnancy. At this period her appetite also improves. As a rule the patient desires to empty the bladder during the first twelve hours of delivery and will be able to do so when the

necessity for so doing is pointed out to her. But in some cases especially among the primiparae not only is there no desire to pass urine but even the act of so doing is for some hours impossible on account of extreme bruising the urethra undergoes during delivery and its tenderness. Further the diminished abdominal tension combined with the relaxed condition of the abdominal muscles renders the emptying of the bladder difficult.

The bowels seldom act of their own accord so long as the woman is in bed, due in part to the recumbent position and in part to the relaxed condition of the abdominal muscle and lowered abdominal pressure.

Occasional pains known as "after-pains," due to the contractions of the uterus are common and generally continue one or two days but may persist longer. These after-pains become worse when the infant is put to breast, as this acts as a stimulus to the uterine contractions.

When the patient is allowed to sit up for the first time after delivery she almost invariably suffers from a certain amount of muscular weakness. This, however, soon passes off and in a short time she regains her usual strength and energy. If after she has returned to her ordinary mode of life she still suffers from weakness and lassitude there is always some pathological condition present and its cause should be determined and removed.

1. Management of the Puerperium

From the foregoing description it is clear that the management of the puerperium consists essentially in the maintenance of the normal functions of the organs of digestion and of elimination (the kidneys, the bowels and the skin) and promotion of the involution of the uterus. The food must be simple, sufficient and appetising, and the organs of digestion and elimination should not be over-taxed by food which is difficult of digestion and assimilation.

When the woman is up and able to take a due amount of exercise a correspondingly simple and more varied diet may be allowed. A puerperal woman more than other people requires the maximum amount of nourishment which she can digest easily

and in this respect the inclination of the woman herself is the safest guide.

For the first two days light nutritious and liquid food like milk, rice conjee and coffee is all that is required, the only solid food for which the patient cares being rice, bread, biscuits etc. On the 3rd day if the bowels have acted solid food may be given supplemented with liquids. From this time onwards the dietary becomes more liberal, but so long as the patient remains in bed her meals may be given in small quantities but at short intervals rather than in large quantity at long intervals. The food should be appetising we said, as even if the appetite is good the squeamishness and nervous excitability of pregnancy will not have sufficiently passed off to enable the patient to consume the necessary amount of food when the food is not tempting. Hence there should be considerable **variety** in food.

The use of alcoholic beverages as stimulants is only necessary when the patient is in a weak state of health from previous ill-health, prolonged or difficult labour or haemorrhage before or after delivery. As food or a pick-me-up, however, and particularly in the case of a woman who is nursing, the use of a little beer or country arrack or toddy is permissible and in some cases might enable the patient to nurse her baby which she might not otherwise be able to do. Prof. Bunje sums up his observations regarding the effects of alcoholic drinks on the nursing mother thus: "The daughter of a drinker is rarely, if ever, able to nurse her children. As a rule, where the father has been a drinker, the daughter loses the power to suckle her children and the capability is irrecoverably lost to all future generations. The incapability of nursing is no isolated phenomenon. It is accompanied by other symptoms of degeneration, in particular by a want of power to resist the inroads of disease of all kinds, nervous disorders, tuberculosis, decay of teeth. The children are insufficiently nourished and so from generation to generation the work of deterioration goes on leading at length after endless suffering to the ultimate decay of the race." Nevertheless, we see to-day even medical men prescribing stout or toddy to nursing mothers. As a matter of fact the use of alcohol

in some form on the part of one or both the parents is among the commonest causes that have produced so many women that **cannot nurse** their children even if they would.

Attention to the bladder is one of the most important duties of the nurse during the first 24 hours after delivery and in no case should a lying-in woman be allowed to pass more than 6 hours without emptying the bladder. It has been found by experience that nearly half the number of women will not pass water of their own accord within the first 12 hours of delivery, and so in all such cases steps should be taken to ensure that the bladder should be emptied. To this end after 6 hours have elapsed warm stupes may be applied over the region of the bladder, and this often produces the desired effect; or the patient still in the recumbent position may be placed with the buttocks over a bed-pan containing hot water. If these measures are unsuccessful the patient may be cautiously turned on her hands and knees (unless she is too weak to do so) and asked to empty the bladder. If this is not successful she may wait another 3 or 4 hours longer and then if the application of stupes and alteration of position still fail a catheter must be passed by **sight**. This should be done preferably by a nurse or skilled assistant. The vulva must be exposed and carefully washed with an antiseptic lotion especially around the orifice of the urethra in order to remove all discharge, blood and lochia. A female catheter, glass or metal and well-sterilised by boiling for say 5 min. is then passed by **sight** directly into the urethra without touching the surrounding parts. The bladder should be emptied atleast once in 6 to 8 hours.

The use of the catheter must not be continued beyond the 2nd day as it is likely to produce a habit in the patient and also there is the risk of infecting the bladder, which is very great after the 2nd day on account of the presence of the lochia which may perhaps be decomposing. Luckily by this time the patient may be allowed to kneel up in bed or even to stand by the side of the bed, and in this way it is possible for her to void the urine of herself.

A laxative should be given on the morning of the 3rd day after delivery, and its administration is, as we have seen,

required in almost every case for reasons already mentioned. Castor Oil is the most commonly used drug and possesses certain advantages, but it is very nauseating and commonly many patients cannot take it. As a substitute may be given sulphate o magnesium (Epsom Salts) or Sulphate of Sodium (Glauber's Salts) or citrate of magnesium or any purge the patient is accustomed to ordinarily, but a double dose requires to be given to ensure a satisfactory action of the bowels. If a motion does not result in time a warm soap-water enema may be administered. The aperient may be repeated every third or 4th day during the puerperium if the bowels do not act satisfactorily.

Sleep. Plenty of sleep is of importance for the puerperal mother in order that she may recover from the mental and physical exhaustion of pregnancy and delivery. Nature recognises this fact and it is rare to find that a puerperal woman does not sleep enough unless she is troubled with severe after-pains which interfere with sleep. In the absence of after-pains sleeplessness in the puerperal woman is a serious symptom and is always due to **septic infection** or to some **threatening mental** derangement. Hence every attempt should be made to determine the cause of sleeplessness; and if it persists sleep should be obtained by the use of hypnotics like veronal, bromidia, veramon etc. The use of opium is contraindicated especially if the patient is nursing her baby as it is likely to affect him through her milk.

In matters therefore of complications like fever, a foul lochia, sleeplessness etc. occurring during the puerperium, a medical man should be consulted at the earliest, as they can then be treated more effectively before it is too late.

Treatment of After-pains. The common cause of severe after-pains is as we said the presence of blood-clots in the uterus and consequently the most satisfactory method of getting rid of the pains consists in expelling the clots. To do this gentle massage and compression of the uterus are usually sufficient, but in some cases a uterine douche may be required. Relief may be obtained by a hot compress applied over the lower abdomen, and in severe cases where the pains are unbearable a little opiate may be necessary. Here again a medical man should be

consulted and care taken that the baby is not affected by the internal medication of the mother.

The involution of the uterus and the function of lactation are both promoted by proper attention to diet and to the action of the bladder and the bowels; but there are also other means by which their course can be favourably affected. They are: (1) the proper management of labour especially the 3rd stage of labour or the delivery of the placenta or after-birth; (2) the maintenance of the uterine asepsis. At the beginning of the puerperium the uterus and the vagina in a normal patient on whom no examinations have been made after the birth of the child have been proved to be aseptic i. e. free from bacteria; and accordingly in all cases in which bacteria are subsequently found in the genital canal the presumption is that they must have been introduced frdm without through unclean fingers, unclean instruments and dressings, or through decomposing lochia on the vagina and bed clothes. Hence if the lochia becomes fetid or the involution of the uterus does not follow the normal course the vagina should be douched twice daily if necessary with an antiseptic solution; the most suitable fluid is either sterilised normal saline (four drams of sodium-chloride dissolved in 4 pints of water) or solution of lysol (4 drams to 4 pints of boiled water) or solution of cyllin (2 drams in 4 pints of boiled water). Lysol has the advantage of containing soap which increases its cleansing property and acts as a lubricant. All solution for vaginal douching should be sterile, used warm and in sufficient quantity; the douche can should not be placed higher than 2 feet from the level of the pelvis.

It must be understood that a vaginal douche given within the 2nd or 3rd day of delivery is practically a uterine douche, as the cervical canal is then practically patent and fluid might gain access to the uterus from the vagina.

In all cases of puerperium, we repeat, even in normal cases it is advisable to have a skilled nurse or midwife in attendance so that any small complications may be discovered, set right in time or brought to the notice of the medical attendant. She will also be attending to the cleanliness and comfort of the

new-born infant. This means so much of rest and sleep to the mother, which, as we pointed out, is an important factor in her recovery from the exhaustion of pregnancy and labour.

IV. The New-born Infant and its Care

Weight. The average weight at birth of an European baby is 7 lbs. and that of an Indian baby 6 lbs. The weight is the best criterion of an Infant's progress and may be taken daily or every second day during the first week of birth; after the first week the infant should be weighed once a week.

Authorities differ regarding the average weight of a normal healthy baby throughout the first twelve months of life, and the figures given below will be found easy to remember and accurate enough as a guide to the baby's development. It must be remembered, however, that great variations on either side may be perfectly normal for any particular baby.

Weight at Birth	...	..	6 lbs.
Weight at 1st Month	...	...	7 lbs.
,, 2nd ,,	...	...	9 lbs.
,, 3rd ,,	...	...	11 lbs.
,, 4th ,,	...	...	13 lbs.
,, 5th ,,	..	...	14 lbs.
,, 6th ,,	...	...	15 lbs.
,, First Year	. .	..	20 lbs.

An easy way to remember the above figures is this:

1. From Birth to 1 month old—only 1 lb. is gained on account of the fall in the initial weight from want of food, passage of meconium and certain adjustments to the new surroundings of the outer world and also many a time to Jaundice. The birth-weight is normally regained about the 7th to 8th day, but in premature babies the birth-weight may not be regained until the end of the 2nd or 3rd week.

If there is a steady loss of weight it means either the breast milk is deficient or that there is some abnormal condition or disease.

2. From the first to fourth month the baby should gain rapidly on an average of 2 lbs. per month.

3. From the fourth month to the sixth month, the average gain in weight is about 1 lb. a month.

4. In the last six months, i. e. from the 7th to 12th month, the gain is **still less** and is only about **5 lbs. in 6 months**. This is usually due to the presence of diarrhoea or fever during the teething period, which tends to retard the gain in weight.

The above figures are useful in judging whether a baby is up to the average weight for his age. Moreover, as will be seen later, the Artificial feeding of Infants is now usually calculated from the baby's weight, and many under-weight babies do not thrive well unless fed nearer to the weight they should be for their age rather than by their actual weight.

Length. The length of the baby is approximately 18 to 20 inches at birth, and 28 to 30 inches at one year.

Size of the Head. The head of the normal baby is considerably larger **in proportion** to the rest of the body than that of the child or adult; and during the first six months of life its circumference actually exceeds that of the chest. Mothers, often not realising this, fear some condition such as hydrocephalas (water in the brain).

The circumference of the head at its maximum point is:

At birth	... ...	13 inches
and at one year	...	18 inches

The **anterior fontanelle** is normally open at birth. If closed at birth it indicates microcephaly (undeveloped, small head), one of the worst forms oi mental deficiency. Normally the anterior fontanelle closes about the 18th month and if unclosed at 2 years the condition is perhaps due to rickets or congenital syphilis.

The **posterior** fontanelle is also present at birth but is normally closed before 6th or 8th week. It may, however, be closed even at birth.

Temperature or body-heat. The infant's temperature normally is the same as that of adult. If is generally taken in the groin and may be found to be between 98° and 99° F. If may also be taken in the rectum, in which case the normal temperature is about 99.4°.

The heat-producing and regulating centre of the Brain being extremely unstable at this age variations of temperature may occur even with very slight irritating cause. For example, an ordinary "cold" is sufficient to raise a baby's temperature to a 101° F in a way that would not occur in the adult; similarly in more serious illnesses a temperature of 105° F occurs more readily in them than in the adult and should not be regarded with quite the same degree of alarm. At the same time the great liability of childhood to be affected by extremes of cold and heat should be remembered, the smaller the baby the greater is the tendency to be so affected, and in the case of premature babies quite a high temperature may occur without apparent cause.

Pulse. The normal rate of pulse in infants is 120 to 140 per minute, and the rate gradually falls through childhood to the adult rate of 72. It can usually be taken at the wrist or more satisfactorily from the auscultation of the heart. But the most valuable index of the state of circulation in an infant is the level of the anterior fontanelle.

In conditions of shock and collapse from diarrhoea the anterior fontanelle becomes sunken and the degree of this is an index of the extent of depression of the blood-circulation.

Respiration. In infants the respiratory rate is usually between 35 and 25 per minute, and is faster therefore, than the adult rate of 18. It is on this account less valuable as a sign of pneumonia than the adult, in whom an increased rate of respiration is indicative of pneumonia, and in the case of infants change in the quality of the breathing from the normal to the typical grunting type is a more valuable index of pneumonia or any other form of respiratory embarassment. The normal rhythm of respiration in infants is often very irregular.

The Stools. Examination of stools is one of the best guides as to digestion of food. Ordinarily an infant has daily 3 or 4 stools from birth to one year. But suppose a baby has one good stool a day this may also be regarded as satisfactory.

"Meconium" is the name given to the stools passed by an infant during the first few days of its birth. It is of dark green colour gradually changing to the normal type. In the first 24

hours of birth bowels are opened several times. If after the first 12 hours of birth no meconium is passed by the infant insert up the anus your little finger (with the nail pared to the quick) well lubricated with vaselin or castor oil; meconium nearly always follows the withdrawal of the finger unless there is an imperforate anus, when the obstruction will be felt by the finger.

Imperforate anus requires the interference of a surgeon.

Urine. The amount of urine passed in 24 hours by the normal infant is difficult to measure and is of little importance, as diseases in which the daily quantity of urine passed is of diagnostic value are of very rare occurrence at this period. Urine is generally passed soon after birth especially when the baby encounters the cold of the mother's discharges in which it is lying soon after birth, or it may pass during the bath; at any rate it should pass urine within the first 12 hours.

If the child has not passed urine for some hours after birth there will usually be seen and felt a distended bladder above the pubes. The orifice of the urethra should be moistened with a little warm oil, the vernix caseosa be gently removed, the baby should then be given a teaspoonful of boiled and cooled water and put in a warm bath. If the urine is passed in the bath the stream can usually be seen or felt. If this fails the nurse should be asked to apply hot flannels on to the lower abdomen and carefully watch the napkin for a further six hours. If without result at the end of that time a sterile soft rubber catheter may be passed, which offers no difficulty in either sex.

Rarely the urethral opening may be blocked, especially is this is the case in male infants, in which case a medical man should be entrusted with the operation of making a niche.

Teething. The first tooth is generally cut at the 6th month, though this is subject to considerable variations and if no tooth has cut at the end of 12 months rickets may be suspected.

Teething is a physiological process and should not strictly speaking give rise to any troubles. But it often does, as pregnancy which is also a physiological process does often give rise to certain digestive troubles such as vomiting. So the features commonly met with when a baby cuts the tooth are

salivation, vomiting, diarrhoea and loss of weight. The baby often puts his fingers into the mouth (though this may be a sign of hunger). Sometimes the baby may scream also. All these symptoms are not necessarily due to teething and may be due to painful conditions like colic, earache etc. or may be due to hunger or even wetting of the clothes. Before, therefore, putting aside a case as due to "teething" it is advisable to exclude the more serious conditions noted above.

Milestones in the Infant's Development

At 3 months—Baby should hold his head up, before this it merely flops about.

At 6 months—First temporary tooth appears (The permanent set of teeth appears only after the 6th year.

At 9 months—Baby sits up without assistance and attempts to crawl.

At 12 months—Baby attempts to walk with assistance; attempts to "talk."

At 18 months—Anterior fontanelle closes.

At 30 months—All the temporary teeth cut, in all 20 in number.

The commonest condition causing delay in the above milestones are **rickets** and mental deficiency; and if the baby is more than six months behind in reaching any of these milestones he has probably one or both of the above conditions and a doctor should be consulted.

Care of the Infant during the first Two Weeks of Life

The present generation of mothers have luckily come to realise that proper care is absolutely necessary to assure healthy children, and are anxious to give their newly-born infants every opportunity to develop in a healthy normal manner, and will avail themselves of every opportunity for enlightenment. The older methods of the grand-mother and the mid-wife are rapidly losing favour, and we are now entering an age of understanding and are capable of accepting information about Child Hygiene and Infant Care made available through Periodical Lectures and Health Demonstrations.

Infant Care includes every phase of planned management that will contribute to the development of a normal healthy child. As Infant Mortality is extremely high within the first 24 hours of birth proper care of the Infant immediately after birth should decrease this high and immediate mortality, as well as mortality at a later period of life.

The room in which the delivery should take place should be warm in order to prevent exposure of the newly born infant.. Immediately after birth rapid evaporation from the wet skin quickly produces chilling; no time should therefore be lost in getting the infant wrapped and into a warm bed (or next to the mother) immediately after attending to the eyes and the umbilical cord. This ensures against chilling and allows respiration to become established before bathing and dressing the infant—which means a certain amount of handling and manipulation.

If a premature baby is anticipated it is essential that a warm bed should be previously prepared to receive the infant.

The establishment of respiration in the great majority of cases is immediate and spontaneous; hence, no measures are necessary to facilitate breathing; even when spontaneous respiration is delayed it is usually best to let Nature take its course, and it is especially wise to do little or nothing if the child is **blue**, as respiration will follow naturally in such cases.

In the case of extreme "pallor" it is well to remember that an intracranial injury is very likely to be present, and that forceful measures to bring about respiration are likely to increase the extent of the injury.

If the child does not cry within the usual time a slight glancing blow on the soles of the feet may induce the cry; and in all instances where resuscitation measures are necessary care should be taken to prevent the infant from becoming chilled.

Care of the Cord. There are two important points to be considered in the case of the Cord: (1) the prevention of bleeding and (2) the prevention of infection. The cord being the most potential source of infection strict antiseptic precautions must be observed in caring for the cord. Particular attention should be paid to tightening the ligature, and the cut surface

should be carefully sponged to detect oozing. A sterile gauze dressing should be applied to the cord and held in place by means of a bandage. The dressing should be inspected at frequent intervals during the first few hours to detect any bleeding due to faulty ligature.

Care of the eyes. Routine care of the eyes at birth is a most necessary procedure to prevent gonorrhoeal infection. This is necessary although gonorrhoeal infection is not suspected in the mother. Crede in 1881 adopted the method of putting a drop of solution (8 grs. in one ounce of water) of Silver Nitrate into each eye when the infant was born and thereby reduced the incidence of gonorrhoeal ophthalmia considerably. A solution not stronger than 4 grs. to one ounce of water apparently accomplished the same result with less attendent inflammation and swelling of the conjunctiva. It is a legal requirement in some Cities that silver nitrate solution be instilled into the eyes of all infants soon after birth. If an 8 grs. solution is used the eyes should be washed out with normal saline or boric lotion, but this precaution is not necessary if a 4 grs. solution is used. Hence the precaution should include—gentle wiping of secretion from the eyelids of the baby as soon as it is born, and the immediate instillation of the silver nitrate solution. It is important that the eyelids should be well separated so that the solution may reach the entire conjunctival surfaces.

The first bath. After the cord has been tied and the eyes have been attended to the infant should be bathed and dressed, If the infant is premature or if the outside weather is cold the first bath may be delayed. The bath should not be given until respiratory and circulatory functions have been well established; the nurse should guard against injuring the skin and over exposure during the bath. Warm clean bland oil, vegetable or mineral, should be applied to the body and gently removed with a soft rag; the vernix caseosa is thus easily wiped away leaving the skin in clean soft condition. Great care should be taken to remove the oil completely from the folds of the neck, the groins and the armpits, where the skin is thin and the surfaces are approximated. After this the baby may be bathed with soap and

warm water avoiding chill and exposure during and after the bath. Whenever possible it is advisable that the infant should have a room separate from the mother—this allows for the maintenance of better surroundings for the infant and for more relaxation and sleep for the mother.

A room that has adequate sun, space and ventilation should be selected. Bright light should be avoided as far as possible by proper shades. The nursery should be kept clean, the dust should be removed with a damp cloth; and the windows should never be kept shut except during the bath to avoid draught of wind.

The bed should be warm and there must be minimum clothing consistent with the outside temperature. A rubber sheeting should be used to prevent the bed from becoming soiled or damp. The bed sheet is next applied and over this it is well to use a washable pad to absorb the moisture.

Usually the mother assumes the care of the infant. But during the first few days atleast a nurse should be made to assume the actual care of the infant. Such a nurse should not only be capable of giving the necessary care to the infant and mother, but should be herself in perfect health, intelligent, quiet, neat and orderly, and possess a high degree of common-sense. Every person who assumes even temporary charge of an infant should receive careful medical examination. They should be free from enlarged tonsils and chest disease of all sorts. Instances are common where tuberculosis and gonorrhoea have been transmitted to infants by nursemaids, and this can be prevented only by educating the public to take necessary precautions while engaging domestic help.

Repeated upper respiratory infections in infants such as colds, cough etc. can frequently be directly traced to the attendant or to some member of the family who is in daily contact with the child. The young infant should especially be guarded from other children in the family. Visitors should be kept from the baby as far as possible.

Regularity of care is essential for the proper growth and development of the infant. Habits are formed very quickly and

from the beginning every effort should be made to establish a sensible and orderly regimen to which the infant may adjust himself. Feedings should be given at a regular and definite hour. If the infant is asleep when it is time for feeding he should be awakened. Likewise if he is awake and crying he should be made dry and comfortable and should be allowed to cry until time for the next feeding or may be quieted with a few teaspoonfuls of cold water. Pernicious sleeping habits can easily be established in the very first week of life by rocking the bed or carrying the infant in order to get him to sleep, but they should be prevented as far as possible. There should be definite time for the bath and for sleep. It is surprising how an infant will adjust himself to a well planned and well regulated schedule, and it is also surprising how stubbornly he will resist these efforts when improper habits have been formed and have to be corrected.

The infant's routine during the first two weeks of life is simple. The mother seldom has milk in her breasts before the 3rd day of the delivery and during this time feeding need not be given at frequent intervals. It is doubtful whether the colostrum which is present early in lactation is of any benefit to the infant. Babies who are not nursed at the breast until lactation has become established seem to thrive and develop as normally as those nursed regularly during the first three days, In most maternity hospitals the infant is put to the breast for 5 or 10 minutes, two or three times during the first day (of 24 hours) and every 6 or 8 hours during the 2nd day. On the 3rd day the regular nursing schedule is established, when the infant is allowed to suck for 20 minutes at 3 hourly intervals during the day and at 4 hourly intervals at night. Frequently the routine consists of 4 hour intervals throughout the 24 hours. The longer interval is satisfactory for the average sized and larger infants but is less satisfactory for smaller babies.

Sterile water (water that is boiled and cooled) should be given to the baby after each breast feed, a few grains (20 grains) of dextrose or lactose may be added with advantage to this water.

During the first three days water should be given every 3 or 4 hours in order to assure sufficient intake of fluid until lactation has become established. What is known as the "inanition fever," which frequently occurs on the 3rd day can usually be prevented if sufficient water is given at this time. After lactation has begun less water is needed, but it is important that it should be offered to the infant at frequent intervals.

The baby should be weighed without clothes at the same time each day during the first week. The best time to take the weight is before the bath and the weight should be properly recorded.

The bath is given at a regular hour. It should be given before and not after feeding. As a rule, the most suitable time for the bath is before the 10 O'clock morning feeding. It is probably unnecessary to subject the new born infant to a daily bath during the first few days of life. This is especially true in the case of the immature or delicate infants, who should be handled as little as possible and should not be exposed to chilling, skin irritation and possible subsequent infection.

Preparations for the bath should be complete before the baby is undressed. If the necessary articles are at hand and carefully arranged within easy reach unnecessary exposure of the infant can be avoided. Clean, soft cloth and drying towels should be used; a bland soap is best tolerated by the infant's delicate skin. The temperature of the water should be at body heat and the nurse can easily regulate the temperature.

Talcum powder is to be avoided as far as possible, but a good grade powder such as Woolley's or Johnson and Johnsons' may be sparingly applied over the skin folds. Baby powders containg zinc stearate should not be used because of the danger of bronchial irritation sometimes produced if inhaled by the infant. Most Talcum powders consist of purified Fuller's Earth, which may contain Tetanus germs unless properly sterilised and may give the fatal disease to the young baby through the raw surface of the cut umbilical cord.

[**Lead in Cosmetics.** In Japan in 1922 there was an epidemic of serous meningitis among nursing infants and it was some

time before the cause was found to be lead poisoning. Lead was present in the toilet powder which the mothers used on their skin; its application to their breasts explained the source of the lead that the babies had eaten.]

In male children the prepuce (foreskin) should be first wetted with a little oil, then gently pulled back and the glans cleaned with soap and water during the bath. If the foreskin is left retracted longer than is necessary to clean and dry the surface there is danger of swelling of the organ. If the foreskin is tight circumcision is advised and is best done during the first two weeks of life. If the infant is strong and thriving circumcision need not be delayed. In fact, it is wise to suggest the operation to the parents to prevent trouble in later years.

Oil baths are very useful. The body should be gently rubbed for a few minutes with any warmed bland oil (cocoanut oil, gingelly oil) and the baby bathed with warm water and soap. Oil-rubbing is a form of passive exercise to the young, it increases the activity of the circulation and the body metabolism and stimulates appetite, thus enabling the baby to put on weight rapidly. It is said to be a great preventive of rickets by developing in the body vit. D, which is credited with the power of stimulating the assimilation of Ca salts for building bones and teeth.

Clothing. It is a common practice at the present time to overclothe the infant on account of the vague fear that he might catch cold easily if not properly covered. In fact, it is a dangerous practice to overdress infants or keep them confined to specially warmed rooms like hot-house plants. Few garments are in fact necessary for the new-born babe. It is more practical to supply additional warmth to the baby if found necessary by adding blankets than to subject the infant to the ordeal of numerous skirts, petti coats and dresses.

The clothing must be simple and washable; cotton garments are preferable to wool or silk. In warm weather the clothing should be of light weight. Woollen garments next to the skin are very irritating to the skin. Silk is neither absorbent nor warm. Cotton has the further advantage that it washes easily and is less expensive.

The diapers should be light and of absorbent material which will stand constant washing and boiling. They should be folded lengthwise and pinned at the sides. This method causes less irritation of the skin than when folded in a triangular shape and pinned in the centre. As soon as the diapers become wet or soiled they should be changed and not used again until they have been thoroughly washed, rinsed, boiled and dried; much of the skin irritation about the buttocks or thighs is caused by insufficient rinsing and boiling of the diapers. Irritation about the diaper-region is often caused by the acidity or alkalinity of the stools and urine.

When the first signs of irritation of the buttock is noted meticulous care in keeping the infant clean and dry is an absolute necessity. If the skin about the buttocks becomes excoriated it must be carefully cleaned with warm bland oil instead of soap and water. It should then be protected with zinc oxide ointment and cold cream mixed in equal parts.

Care of the mouth. In healthy babies the mouth is kept clean by giving drinks of warm water between the feeds. Wiping the inside of the baby's mouth damages the delicate mucous membrane and may lead to thrush. If wiping inside is necessary it is best done by placing a soft piece of clean rag around the finger and gently swabbing the mouth with Glycerine of Borax. Provided, however, ordinary cleanliness is observed with regard to nipples, teats, bottles etc. there will be no likelihood of trouble.

Cleanliness is the whole secret; a few curds from a previous feed lying on the tongue or the roof of the mouth will not cause trouble if cleanliness is practised.

Prevention of Infection. The new mother should be instructed in the ways and means of preventing her baby from acquiring the common infections. She should be told that no one with a cold should be allowed near the baby. She must know that the common cold is the basis of most of the illnesses of infancy and childhood and that the incidence of such infections can be decreased by simple precautions. She, herself, must always wash her hands before caring for the infant. He should

not be kissed about the face. If the mother is subject to frequent colds she will most surely infect the baby.

The father should not touch the baby after coming in from his work without first washing his hands.

"Baby-soothers" and "Comforters" are dirty and dangerous carriers of dust and dirt and microbes of disease and should be avoided. The mother should be advised to avoid crowds when the baby is taken out for the daily airing. (See under "Defects of Teeth.")

It is the experience of doctors that once the importance of these preventive measures in the care of her infant is strongly impressed upon the mother, she will be more concerned later in preventing the contractable diseases of childhood when the preschool period arrives.

The Stools. The new mother should be told that a daily stool is **not** an absolute necessity. If the infant is not uncomfortable and if the stools are not hard a bowel movement every other day is sufficient. It should also be explained that 6 or 8 small stools a day may be normal. She should know that yellow or green pasty stools are normal and that small soft curds and some mucus are to be expected especially in the stools of artificially-fed infants.

If the stools are always formed and hard the mother should consult a doctor before laxatives are given. Glycerin or warm water enemata may be used occasionally and if constipation is a frequent complaint the infant's or mother's diet should be altered in order to correct the condition.

The mother should report at once to the doctor any increase in the usual number of stools, the occurrence of watery stools, or the presence of blood or mucus in the infant's stools.

Sleep. A normal infant, during the first few weeks of life sleeps from 20 to 22 hours out of the 24. The sleep is deep and restful and is interrupted only by hunger or discomfort or wetting of the clothes. On the whole during the first six months the healthy infant usually sleeps for 16 to 20 hours a day.

At one year the infant usually sleeps from 14 to 16 hours. It is important that the wakeful period be spent during the day

instead of at night, lest the sleep of the mother and other members of the house-hold be disturbed by the wakeful child.

The early morning feed should be discontinued as soon as possible; this may be done as early as six weeks in order to allow uninterrupted sleep for mother and child from 10 p. m. night to 6 a. m. next morning. At times the infant may sleep constantly during the day and is awake at night. This habit must be corrected by rousing him a half hour or so before each of the day-feedings and insisting upon regular morning and evening periods of exercise and play.

Proper training in habits of sleep must begin at birth. From the very beginning the infant must be put in his bed or cradle while awake to sleep of his own accord. If allowed to sleep in the mother's bed it will be difficult to break off the habit at a later date. Such measures as allowing the baby to nurse, rocking the cradle or the use of a pacifier are not only unnecessary but are in many ways injurious. A healthy infant will go to sleep if he is left alone in a warm comfortable bed, in a quiet room with his appetite satisfied and with his clothes dry. In fact, it is a good practice that soon after a feed, when the baby has "broken his wind" or belched satisfactorily he should be put back in bed and allowed to sleep.

If this routine has not been established early a certain amount of crying must be expected before the child will give up his previous habits.

Loud noises will usually awaken the baby but constant quiet is not necessary. If the infant has a room apart from the general household the normal activities need not be curtailed.

The causes of disturbance of sleep are usually hunger or indigestion; in the breast-fed baby it is more often hunger and in the artificially fed baby it is usually indigestion.

When an infant cries between his feedings we should determine if the breast or bottle is taken greedily and if the baby seems satisfied at the end of the feedings. Does he suck his fists and take an unusual amount of water between feedings? Has the rate of gain in weight been satisfactory?

Indigestion is often associated with flatulence, excessive vomiting and irregular stools.

Nothing will upset the mother and the house-hold more than the new baby who will not sleep; and every effort should be made to discover the cause of the sleeplessness and to correct it.

Drinking a lot of coffee or tea on the part of the mother is also a common cause of sleeplessness in the baby.

Exercise and play. This is as necessary for the infant as it is for the growing child, and exercise in infancy is obtained largely through the process of crying and vigorous movements of the limbs. For this reason a certain amount of crying is necessary for the development of the chest and abdominal muscles. Atleast twice a day at regular intervals there should be a play-time for the infant, when he is unhampered by clothes and allowed to kick; and if the baby is tightly wrapped up he cannot develop on normal lines.

After the first few weeks infants may be trained to enjoy planned exercises; they quickly learn to exert effort when you allow them grasp objects placed in their hands or to push against resistance applied to the soles of the feet. They often enjoy passive leg and hand exercises also and soon learn to voluntarily imitate these movements. The grasp reflex is active in them from birth, and graded arm exercises are valuable in muscle-strengthening and control.

The exercise derived from the handling which the breast fed and bottle-fed baby receives when being held in the arms is invaluable.

Infants who have received proper nutrition need not be prohibited if they show a desire to sit up or to walk earlier than is usual. It is well to make use of the trolley at an early age, for it will stimulate self-help in walking and bodily effort.

Properly selected toys should be placed before him and he be trained to amuse himself and to solve his own little problems. Play may be allowed to the point of fatigue but not to the point of exhaustion.

Out-door life. An infant deprived of fresh air rarely

thrives. It is remarkable what strides it will make with no change other than being taken into the open air daily. Taking the baby out of doors is as important for him as is exercise. The age when out-door-life should be instituted varies with the season and the climate. Babies born in the summer or in a warm climate may be taken out for the daily airing as early as two weeks of age. At first the periods out of doors should be short, not over half an hour. This time may gradually be increased until at the age of 6 or 8 months the infant may spend the greater part of the day in the open air. He may be left outside in a perambulator (pram) with the hood down to guard against glare.

Where there is a nurse wheeling the pram is of greater benefit to the nurse than to the baby, as then she will be more inclined to stay outside long if she can move about freely without having to carry the baby.

It is important that the young infant's eyes be protected from the direct sun and that the head be covered, not with flannel or wool but with a light cotton cap.

During the cold weather the young babe should not be taken out until 4 to 6 weeks of age, and then too if the outside temperature is not very chill. Those infants born in the winter or in colder climates should be given their out-door periods in the house itself with the windows open, when the infant should be dressed as warmly as if he were going out-doors. Even if a baby is strong and is accustomed to exposure he should not be taken outside in severe storms, in heavy winds, dust or in damp weather.

Most mothers now appreciate the importance of taking the baby out regularly each day. Frequently in crowded Cities the lack of parks and quiet streets make it very difficult for the mother to do this. If there is no available space that is protected from the dust and noise of crowd and traffic it is better that the baby be given the necessary fresh air in a room before open windows or on the balcony or terrace of the house itself.

Sun-baths. A few minutes' exposure to the sun in the open after 5 o'clock in the evening is conducive to good health and prevents rickets and tendency of children to catch cold easily.

V. Feeding of Children

Breast-feeding

It maybe briefly stated that when there are not sufficient contraindications the baby should be breast-fed. The greatest argument put forward for the practice is that it is the method Nature has evolved and the one on which the race has survived.

Breast-feeding has several advantages over artiticial feeding:-

(1) On breast-feeding an infant will frequently show a satisfactory gain, say of 2 lbs., a month, on much less quantity of breast milk than on artificial feeding. It is believed also that better development of the jaw occurs with natural sucking and that the right temperature of the breast-milk prevents any risk of damage to the developing teeth.

(2) Breast-milk protein is more adequate for the growth of the body than cow-milk or goat-milk protein, 2 Grms. of breast-milk-protein being equivalent to 3½ to 4 Grms. of cow or goat-milk protein. This fact considerably lessens the work of the digestive apparatus. Certainly feeding difficulties are much fewer with breast-fed than with artificially fed infants, and affecttions like summer-diarrhoea causing a high infant-mortality do occur almost entirely on artificially-fed infants, because breast milk is more easily digestible and is more free from pathogenic bacteria.

(3) Breast-fed infants do resist infection of disease better and have better general health than the bottle fed. Infact it has been proved that immunity against various diseases and infections is transmitted from the mother to the infant through the breast-milk.

The excretion of vitamins in breast-milk is usually of no vital importance as long as the mother is on an adequate intake. Breast-milk ordinarily contains enough Vit. A and B, but vit. C and D must be added. If the mother receives inadequate amounts of Vit. A and B in her diet the amount in the breast milk may decrease and become inadequate.

(4) In many instances breast feeding is simpler and more convenient than preparation of artificial food. This is especially

true in poorer homes where facilities for preparing the food and keeping it are poor. In homes where there are servants to work the mother of course may gain little in the matter of convenience for breast-feeding but is made into a virtual prisoner who has to report in a certain place once every 4 hours. She may have some liberty, however, by substituting an occasional bottle when she finds it necessary to be away more than four hours. She probably gains in health more than she loses in liberty.

By keeping the baby in good health, breast-feeding may save much time, worry and money and the trouble of keeping bottles, teats etc. clean, where a nurse is not available.

(5) One important advantage to the mother of nursing the baby is that it helps involution of the womb (the natural return of the womb after delivery to its former non-pregnant condition and size), and acts as a certain "contraceptive",—a feature which should be recognised by people especially the poor who want to avoid large families and who desire to "space" their children.

Disadvantages of Breast-feeding and Contraindications

1. If through continuance of breast-feeding the health of the infant or of the mother should be or is likely to be, impaired artificial feeding should be substituted, as the risk in breast-feeding may far out-weigh its advantages. The two factors to be given most consideration in judging the merits of any case are (1) the conservation of the mother's general health and energy, and (2) the protection of the baby from infection of disease and its poisons.

In producing the milk a mother must assimilate enough food, not only for her own body's needs, but, in addition, enough to supply the requirements for milk-production; and unless her general health is good enough to withstand this drain it is the part of safety from the mother's point of view to forego breast-feeding. To be more specific—Tuberculosis, Kidney disease, diabetes, Heart disease, severe infections and malignant disease (like cancer) may be mentioned as definite maternal contraindications to breast-feeding; and the strain of these diseases in the

mother might decrease the quantity as well as the quality of breast-milk. So the purpose of weaning is to conserve the mother's strength and protect the infant from infection.

Tuberculosis. If any hard and fast rule can be laid down in breast-feeding it is that no woman with active tuberculosis should be allowed to nurse a baby, the danger is great to both the woman and the infant. A woman with active tuberculosis is very apt to have it stirred to greater activity by the drain of lactation on the body's resources, either hastening the end or preventing the arrest of the disease. The infant is very susceptible to the disease and frequently acquires it by contact. The resistance is poor and the mortality high.

Maternal syphilis. This is not regarded as a contraindication to breast-feed the infant except when the mother may have acquired the disease late in pregnancy or after the birth of the child. During the secondary stage of the disease the mother is certainly infectious and may very well pass the disease on through contact with the skin lesions or by kissing. Ordinarily the mother has acquired the infection before pregnancy or early in the course of pregnancy, and does not have open lesions through which the baby may acquire the disease by contact.

If the baby has escaped infection while in the womb he is in little or no danger of acquiring the disease in this way; but if he has been infected in utero the mother being already infected can nurse the baby without danger.

A syphilitic wet-nurse should not be employed and certainly no uninfected wet-nurse should be exposed to the dangers of nursing the baby of a syphilitic mother.

Acute infections in the mother may cause temporary decrease in the milk supply, but there is no reason to discontinue feeding the baby unless the mother's condition is likely to be rendered grave thereby. The question is of the baby's protection against acquiring the mother's disease Fortunately diseases are not transmitted through the milk but by contagion; so the question resolves itself into one of prevention of transmission of disease by contact.

In acute infections with purulent discharges or infectious

excreta if maintaining good isolation is difficult it is better to express the breast-milk and after boiling give it by the bottle. This, however, will not be necessary very often.

In chronic infections the breast-milk supply may fail, or it may be necessary to conserve the mother's strength. In such cases breast-feeding should be discontinued.

Epilepsy and Insanity are contra-indications only when there is the danger of physical violence or injury on account of the mother's mental state.

The onset of another pregnancy is not necessarily an indication for weaning, though if pregnancy occurs early in the lactation period weaning may be necessary. A mother should not nurse her baby when she has advanced far into the succeeding pregnancy because of the excessive drain on her strength, and by the 3rd month of pregnancy she should wean the child.

It is possible also that suckling during pregnancy may set up reflex uterine contractions and increase the tendency to miscarriage.

If the nipples are badly inverted sufficient difficulty in nursing to warrant weaning may occur. In some instances it is possible to pump the breast or to express the milk manually and feed the baby from the bottle.

Inefficient suckling is usually accompanied by the ingestion of large amount of air, which leads to flatulence, colic or vomiting, off-setting the advantages of breast over artificial feeding. The same condition of inefficient suckling may be met in premature babies, or weak babies or babies with congenital defects like harelip and cleft-palate. In these cases the breast milk should be expressed and fed by dropper or spoon.

Breast-abscess which is opened and is draining freely to the outside is not necessarily a contraindication to nursing. Frequently, however, the pain associated with nursing is intense and the mother may want relief from the discomfort by temporarily removing the baby. If the **nipples are cracked or fissured** and painful a breast-shield may be used with advantage. Of course with a breast- shield efficient emptying of the breast is impaired.

A baby is occasionally removed from the breast because the mother's milk disagrees with him, that is, causes vomiting, diarrhoea or flatulence and colic. Cases in which the mother's milk does not agree with the baby are very rare indeed. These difficulties do almost always arise from an inadequate milk supply with the accompanying ingestion of air. Such disturbances are not indications for weaning, but for clear investigation of the technic of feeding and the possible need for a complementary feed.

In summarising the indications and contra-indications for breast-feeding it may be said that breast-feeding is the feeding of choice unless definitely contra-indicated. The contra-indications must be judged on their merits in each individual case, the most frequent and absolute contra-indication being active maternal tuberculosis.

Lactation. The milk secreted by the breasts during the first few days after delivery is thick and is known as 'colostrum.' It is a concentrated food for the baby, probably conveying immune bodies from the mother to the baby and is slightly aperient.

The duration of lactation shows a wide variation averaging 8 to 12 months. Numerous instances of prolonged lactation are well known especially among Eskimos and savages with a precarious food supply, and it is not uncommon for them to nurse a child several years old. In China 2 years is said to be a common lactation period.

DeLee says that small breasts with thin skins and blue veins visible coursing underneath are apt to be good milk-producers. Heredity seems to have some influence, the ability or inability to nurse their babies apparently running in certain families.

As for the mother's general regimen she should lead a normal life, as free from worry as possible. It is important that she should have sufficient rest and sleep. If possible she should be relieved of house work for a while at least and be allowed to devote most of her time to the baby. She needs a period of rest in the afternoon in addition to the usual night's rest. Insufficient rest or loss of sleep decreases the milk-supply and may ultimately affect its quality also.

Much has been written about the importance of the nursing mother's diet. No very good evidence has been adduced that any one type of food is better than another as a source of breast-milk, but it is exceedingly important that the nursing mother have a sufficient quantity of food to meet her own body's needs and in addition enough to make up the loss through the breast milk secreted. The best advice to her is that she should eat liberally of the foods she likes and is accustomed to. Ordinary plain food is usually all that is required. Many women tend to eat too much. This is especially harmful during the lying-in-period, as it may cause indigestion easily. The time and quantity of each meal should be regulated and care taken to keep the bowels regular by taking plenty of fluid, fruit and green vegetables. She should take a moderate amount of exercise preferably out of doors in order to keep feeling well and have sufficient appetite to take the large amount of food required.

An easy way to increase both fluid and food-intake is by the addition of liberal quantity of milk to the diet; the milk and leafy vegetables also serve to give the additional amount of mineral salts required.

Briefly, then, the nursing mother should have a liberal diet with plenty of fluid and a good night's sleep with some rest in the middle of the day.

Mothers frequently ask whether or not certain articles in their diets will upset the baby. In as much as it is not possible to detect more than a very minute quantity of ingested substance in the breast-milk, it is difficult to imagine how the articles of the mother's diet affect the baby directly. If they do not upset the mother they are not likely to have any effect on the baby's digestion. But sometimes mothers feel that certain articles in their diet make the baby constipated or give him flatulence or diarrhoea. If this relation seems plausible it is an easy matter to omit that article from their diet.

Alcohol and tobacco habit in the mother seems to have no deleterious effect on the infant or the milk supply. But excessive smoking or drinking or emotional disturbances interfere with the appetite and rest of the mother and in that way interfere with milk production.

1. Feeding of the New-born Baby

First day. For the first 12 hours the baby usually sleeps. Sometimes a teaspoonful of warm water with a trace of sugar is given every few hours during this period if awake. There is no harm in this. The baby should then be put to the breasts every 6 hours for a few minutes. This teaches the infant to suck and he obtains some of the valuable colostrum secreted by the breasts; moreover, the suckling of the infant is the best stimulus for the secretion of breast milk.

Second day. The baby is placed at the breasts every 4 hours for a few minutes each time.

Third day. Usually by the 3rd day milk is being well secreted, and the baby is fed in the following manner:

If the milk, however, is not properly secreted by the 4th day and if the baby is not restless or not crying, then it is sufficient to give some **warm water** to which a trace of sugar is added **after the baby has been put to the breast.** But if the baby is crying and the amount of breast milk secreted is found to be insufficient then give the baby a small **complementary feed after he has been put to the breast.**

It is important that the complementary feed should not be too sweet, as its administration carries with it the danger that it may discourage the baby from the more difficult task of extracting milk from the breasts. A suitable complementary feed would be:

One or two ounces of cow's milk diluted with an equal amount of water and a trace of sugar added. The whole is boiled and cooled before being given to the baby.

Frequently the breast milk gets scanty at the end of the first week of delivery, that is when the mother first gets up. It is at this time that every effort should be made to encourage the mother to persist with breast-feeding.

Time of Feeding. It is essential to urge the mother to observe the utmost regularity and to feed the baby by the clock. The importance of regularity in the feeding of infants cannot be exaggerated. By proper timing of the feeds it can be

arranged that the stomach shall have plenty of time to empty itself before the next feed and thus one cause of indigestion will be removed. It must be understood that the child is a creature of habit and if it is trained to regular feeding hours will not expect feeds between these hours.

Two methods are usually employed:

(1) The Four-hourly feeding, i. e. feeding at
6, 10, 2, 6 and 10 O'clock
or at 7, 11, 3, 7 and 11 O'clock. } Five feeds a day

and (2) The Three-hourly feeding, i. e. feeding at
6, 9, 12, 3, 6 and 10 O'clock
or at 7, 10, 1, 4, 7 and 11 O'clock } Six feeds a day

The modern tendency is to feed four-hourly even from the earliest days, provided the baby is of normal weight or above at birth.

Now, the four-hourly feeding has the advantage of lessening the danger of over-feeding, allowing enough time for the complete digestion of the previous feed and is not so exhausting for the mother and gives her more leisure. In consequence it encourages the mother to nurse as it is not such a tie. But it is possible that the child may not be able to wait the full 4 hours, and if it wakes and cries before the next feed it is sometimes better to feed at 3-hours' intervals. But a good mother or nurse can nearly always teach the baby to wait the full 4 hours.

In the case of some babies, especially if small, they do not obtain sufficient milk from each breast-feed in order to thrive well with only 5 feeds a day. More frequent feeding is then advisable in their case.

Suppose the baby wakes up early, say at 5 or 5-30 A. M., it may be given its feed at this time, but during the remainder of the day the feeds should be given at the usual hours. In the same way there is no objection to the last feed being given at 10-30 or 11 at night.

Night-feeding. This should be avoided, because once the baby is fed during the night it tends to form a habit that is difficult to break. A little boiled water may be given if necessary, but the habit of sleeping through the night should be

established as soon as possible. Sometimes an exception may be made for small and delicate babies, when night-feed may be essential to give extra nourishment.

Mothers often notice that after the 7 P. M. feed the baby usually settles down snugly and if left will sleep peacefully till 12 midnight or later, by which time the mother would have sufficient sleep too; the baby is then fed, after which it will sleep again till 6 or 7 next morning. The advantage of this practice is that the 12 midnight soon becomes one, the one becomes two and so on, so that in a few weeks' time the baby and also the mother will have uninterrupted sleep the whole night. It is said that in respect of being trained in this way the girl-babies are much better subjects than the boy-babies.

For four-hourly feeding it is usually best to give both breasts. The mother should not alternate which breast is given first. But for the three-hourly feeding one breast only should be given and the breasts should be alternated at each feed.

Position in feeding. When feeding the baby it is more important to secure a comfortable position. If the left breast is taken by the baby he should be placed on the left arm of the mother and her right hand used to guide the nipple into the baby's mouth; the baby's head should be well supported at the same time, a pillow under the mother's supporting arm is often helpful.

If the flow of milk is too fast it may be controlled somewhat by elevating the nipple a little with the free hand. It is desirable to note that the baby's head is not retracted (thrown back) as this may interfere with swallowing, and that his nose is not obstructed by the breast.

Every baby whether on the breast or bottle swallows some air in feeding; and more quantity is swallowed, however, when sucking at an empty breast. The baby should, therefore, be held up after the feed until this "wind" is belched up.

Length of the feed. If **one breast** is given 15 to 20 minutes should be the limit. If through weakness the baby takes longer it is better to draw off the milk and give it from the bottle. Prolonged feeds lasting half an hour or more exhaust the baby

and lead to air-swallowing, often with vomiting and failure of the baby to thrive.

If **both breasts** are given at each feed 10 min. at each breast is usually long enough. Ordinarily any baby is able to have its full in about 5 to 6 min.

For the first five months of life breast-milk is a complete diet and meets all the baby's needs except its vitamin requirements especially the antiscorbutic and antirachitic principles (i. e. vitamins that prevent scurvy and rickets, or vit. C and vit. D.) For this reason it is advisable to begin the administration of Cod Liver Oil and orange juice or their substitutes during the first month and continue them (in the quantities mentioned in the Section on Artificial Feeding).

A half-ounce of orange juice once daily and half a tea spoonful of Cod liver oil twice daily will take care of this need for the 1st two months of life; after which it should be gradually increased to 3 teaspoonfuls of Cod liver oil and an ounce of orange juice by the age of 3 months.

At 5 months of age breast-milk alone is no longer an adequate diet especially in Iron and other mineral contents, and must be **supplemented** with other foods. The same schedule of additions is followed as outlined in the Section on Artificial Feeding.

About the V month cereal is started with about 2 ounces of boiled cow's milk; after that vegetables, eggs, desserts etc are added (according to the schedule mentioned above) so that after weaning, the breast-fed and the artificially fed baby does receive the same diet. Failure to make these additions to the diet after the V month gives rise tc anaemia and inferior rate of growth.

2. Scanty Breast-milk and means of increasing the Quantity

A. **Giving both breasts at each feed.** The baby should suck the breasts for a much shorter time, (say 3 to 6 minutes) than is usual; otherwise as the result of sucking at the empty breast he fills himself with "wind" and his digestion is upset.

Mothers often think that resting the breast is what is needed "in order that they may have longer time to fill" and that nothing will be gained by giving both breasts at each feed since each breast will have only half the time to refill. It should, therefore, be explained to them that the best stimulus to the secretion of milk is the sucking of the infant and that each breast will now be stimulated twice as often in the 24 hours, and that resting the breast may temporarily make the next feed larger as the breast has longer to fill, but that soon the lack of stimulation will cause the milk to dry up.

B. Any milk left behind should be expressed or withdrawn by breast pump and given to the baby with a spoon or bottle. Quite a surprising amount of milk is often left behind even when a hungry baby has finished and appears to have got all that was there. Withdrawing the milk has two advantages:

(1) The complete emptying of the breast is next to sucking of the infant the best means of increasing the supply of milk. Dairy-men appreciate this fact in milking, and a bad milker who does not completely empty the udder may ruin the milk supply of his cow.

(2) The extra milk will make a valuable addition to the bottle feed.

C. Hot and cold sponging is a valuable stimulant to the secretion of breast-milk. Two basins are necessary, one filled with cold water and the other with water as hot as can be comfortably borne. Sponge the breast first with cold water and immediately afterwards with the hot. This should be repeated several times and the whole completed after rubbing with a dry rough towel. These measures should be carried out two or three times daily after the feeds.

D. Attention to the general health of the mother—We repeat here that if the diet is well-balanced and sufficient for the mother's needs little or no effect on her milk will result from increasing it. Further more, any tendency to over-feeding may upset her digestion. On the other hand if the question of diet has been neglected it should be properly reformed. Plenty of water and atleast about a pint of milk should be taken daily; the

mother should have enough of sleep; retiring to bed early and lying down for one or two hours during the day are advised. Some mild out-door exercise is good but not to the point of causing fatigue. All domestic worries should be excluded as far as possible.

Lactagol—a preparation derived from cotton seeds has the reputation of increasing the flow of milk. It is given in tea-spoonful doses as a drink with boiled milk three times daily. We consider however that a cup of oatmeal or ragi porridge with cow's milk for breakfast is much better than lactagol and is certainly much more nutritious.

3. Insufficiency of Breast-milk and Complementary Artificial Feeding

If sufficient improvement in the secretion of milk is not obtained after the above measures have been tried for a few days and if the amount of milk is not adequate it is advised to have recourse to Artificial Feeding of the infant **in addition to** breast-feeding. Breast-feeding should, however, **never** be completely replaced by artificial feeding, since in most cases where this is done the supply of breast-milk rapidly comes to an end. The reason for this is:—As has already been shown above the most important factor in maintaining the secretion of milk is the sucking of the infant; therefore, when the milk is already deficient if the breast-feed is completely replaced by an artificial feed the breasts will no longer receive the necessary stimulus for the secretion of milk, until finally there is little or no secretion at all. Infact when we desire to stop the secretion of breast-milk in order to wean an infant the best method of doing so is never to allow the baby to suck the breasts; this tends to dry up the milk slowly and steadily, and if the milk is already deficient this method will prove more efficacious.

If there is no secretion of milk it is useless and even dangerous to allow the infant to suck at an empty breast, as in that case, we have seen, the baby will swallow air and get "windy."

The complementary artificial feed, (that is, the feed that an infant may be given in addition to the breast-feed when breast-milk is deficient in quantity) should be **digestible** and not too sweet, otherwise the baby loses his appetite for breast-milk. The best mixture is one consisting of equal parts of milk and water with addition of half a level teaspoonful of sugar to every 2 ounces of the mixture.

The ideal method is to give complementary feed after every breast-feed except the first, which is generally an ample one as a result of the breasts filling overnight. When this is not practicable it should be given after the 12, 3 and 6 O'clock feeds; or, if the infant is being fed **four-hourly**, after the 10, 2 and 6 O'clock feeds.

The size of the complementary feed should be judged approximately starting with small amounts and increasing if the child is not satisfied or the gain in weight is not satisfactory. One or two ounces for each complementary feed is usually sufficient and it is better to err on the side of **giving too little** rather than too much, as otherwise the baby **will not completely empty** the breast and the milk (breast-milk) will tend to fail progressively.

If the breast-milk is grossly deficient it is usually best to **wean** the baby rather than make attempts to keep teaspoonful amounts going. In such instances the best thing would be to increase the number of complementary feeds and discontinue the breast.

4. Disturbances accompanying Breast-feeding

Over-feeding. This is not such a common difficulty in breast-feeding as is "Under-feeding," since Nature provides outlet for the excess of food by slight regurgitation or vomiting after the feed, "posseting" as it is named.

When serious disturbances arise they are usually due to the frequent feeds rather than to an excessive quantity taken at suitable intervals. Over-feeding is generally known by the baby at first gaining weight rapidly and later by crying with indigestion and colic. The stools are at first frequent, bulky and

undigested; and later much mucus may be present and there may be soreness of the anus.

If over-feeding is suspected the best method is to lengthen the intervals between the feeds and if necessary reduce the quantity of the feeds.

The composition of the breast-milk varies in different individuals, and in the same individual at different periods of lactation, at different feeds and even at the different stages of the same feed. But in spite of such variations, breast-milk is so digestible that it is unusual for it to disagree. We should not, therefore, rush to wean the baby because the mother's milk is "blue" or "thin" (as the first-drawn milk is generally apt to be) or because the milk is "windy," which, as mentioned already, is always due to air-swallowing from sucking at the empty breast.

Failure to gain weight and **crying** especially an hour or so before feeding time are usually the first signs of an inadequate milk-supply. **Sucking the fist** may or may not be a sign of hunger, but it often is.

Refusing the breast is also frequently a sign that the breast contains very little milk, as babies usually take no interest in an empty breast.

Falling asleep at the breast after a short period of nursing should rouse suspicion that the supply is scant. **Vomiting and flatulence** may be persistent and troublesome due to the baby's nursing at an almost empty breast. **Constipation** may occur in breast-fed infants and is generally an early sign of a decreasing milk supply, especially if accompanied by the slowing of the rate of gain in weight.

Diarrhoea in breast-fed babies is much less common than in artificially-fed babies.

Sometimes, however, the breast-milk is normal in amount, and yet the baby does not thrive. In some of these cases it is due to the high sugar-content of the breast-milk, which gives rise to acidity of the stools in the baby. This condition can be corrected by giving the baby 1 or 2 ounces of simple whole boiled Cow's milk without the addition of either sugar or even water, **after each breast-feed.**

There are a very few cases indeed where the mother's milk does not agree with the baby and the baby does not gain in weight. In such cases a wet-nurse should be tried, and if this also does not succeed the baby may be successfully reared on artificial food.

5. Weaning the Baby from the Breast

In actual practice weaning of the baby is usually brought about by the use of complementary feeds, which have to be gradually increased until breast-feeding is entirely replaced by artificial. If the mother has a plentiful supply of milk which persists, the baby is kept on the breast till about the 8th or 9th month. At this stage there are usually 5 feeds per day, say at 6, 10, 2, 6 and 10 p. m. night.

Preparing the baby for weaning. First, one of these feeds either the 10 a. m. or 2 p. m. one is replaced by 6 ounces of boiled pure Cow's milk (or with a few grains of Citrate of Soda added to it as explained under "Citrated" milk); after a few days (6 or 8 days) the other midday breast-feed is replaced by the cow's milk, leaving then practically only 3 breast-feeds. Next, the evening 6 P. M. breast-feed is replaced by the cow's milk, and then the 6 A. M. morning one, and last, the 10 P. M. night feed. The total quantity of cow's milk that can be given to the baby for the five feeds need not exceed 30 ounces, that is, an average of six ounces per feed.

In omiting the breast-feeds there may be slight congestion of the breasts at first, but soon it will disappear; in fact by omitting the breast feedings over a period of 10 to 15 days the breasts gradually cease secreting and the pain of congestion disappears.

When there is painful congestion of the breasts the weaning process should be slow; ice bags on the breasts are helpful. Restriction of diet, especially fluid-intake by the mother will be of considerable help in reducing the congestion. Application of Pigment Belladonnae is of little avail and is hardly needed. The pigment is sweet and should not be kept within reach of children, as even the smallest quantity entering the mouth is poisonous, producing dryness of the mouth and throat and

delirium. Belladonna is allied to the common Indian plant, the *Datura* (*Ummattai*).

Weaning rendered necessary before the 9th month by the mother's illness or for any other reason is carried out on the same principle, that is, doing it gradually (if there is time) so as to allow the breasts to dry up a little more slowly, with less congestion and pain. Complementary feeds appropriate for the age in amount and proportions are substituted for one feed at a time until the breasts are sufficiently dried to prevent discomfort from stopping nursing.

It is generally believed that sudden weaning is apt to produce digestive troubles in the baby. There is no ground for this belief, as repeatedly babies have been changed abruptly from the breast to the artificial feeding without the slightest disturbance. It is important, of course, that the artificial feed be properly prepared and rationally administered. The baby will often refuse the first feed or two, but if allowed to become sufficiently hungry will take the bottle as eagerly as the breast. Many difficulties at weaning-time arise from the mother's inexperience; she should, therefore, carefully follow the details of preparing the feeds and giving them to the baby.

Weaning in general more or less takes care of itself and gives no trouble if the artificial feeding is properly proportioned and correctly given. It is merely the substitution of the proper artificial feeding for the breast-feeding, and may be carried out as rapidly as circumstances may demand or as slowly as necessary to avoid painful congestion in the mother's breasts.

VI. Artificial Feeding of Infants

In drawing up a diet for an infant we are guided practically by the same principles as those on which the adult diet is based The responsibility, however, is much greater, because the infant exercises no choice in the selection of his food, he receives only what is offered him, and is dependent entirely on the intelligence with which his diet is chosen for him. In an older child or adult the appetite will lead him to choose a fairly adequate diet; but the infant, of course, has no opportunity to make use of his appetite.

It is still the general opinion that breast-milk is the best food for an infant up to 9 or 10 months of age, when it has usually to be weaned from the breast; and other types of feeding have been judged by comparison of their results with those of breast-feeding.

In the absence of breast-milk the milk of various animals was turned to as a substitute, being the food Nature adapted for the young of the species. Cow's milk is the cheapest and most plentiful in our Country, and for that reason has found the widest usè here. Goat's milk, Ass's milk and Mare's milk are used in various parts of the world, where these animals are most plentiful. Goat's milk has the advantage that the goat does not suffer from Tuberculosis; when fresh it is excellent, and although it is believed that babies fed on goat's milk do sometimes develop a form of anaemia there is no foundation for such a belief.

Buffalo's milk is unsuited for infant feeding as its casein however modified is said to be hard of digestion by the infant's stomach.

Most of the difficulties of infant-feeding can be attributed to the fact that the young digestive apparatus must handle relatively large quantity of food as compared with that in the adult; this necessitates considerable attention to the physical form in which the food is given, and since the infant has no means of masticating food either liquids or soft solids must be used.

In the light of the present knowledge we may say that an infant's diet should meet the following requirements:

(1) It should contain proteins of such quality and in sufficient quantity as to meet the requirements of growth and repair.

(2) It should contain enough Carbohydrates and fat to supply the energy-requirements not met by proteins.

(3) It should contain all the Vitamins (Vit. A, B, C and D) in sufficient quantities.

(4) It should contain mineral salts, especially of Ca, P, Iron and Iodine—in adequate quantities.

(5) It should provide sufficient calories for heat and energy-production.

(6) It should contain sufficient amount of water for free action of the skin, kidneys and the bowels.

(7) Most important of all, the food should be free from harmful bacteria and injurious substances.

These seven requirements are laid down as the standard by which a diet for an Infant ought to be prescribed.

Food Materials. Now, breast-milk is the simplest and the best way to meet the above requirements when it is available. But if artificial feeding is to be resorted to, cow's milk immediately suggests itself as an inexpensive, abundant and well-adapted source of the infant's diet. It should be remembered however, that cow's milk is satisfactory only because it meets most of the requirements of a good diet, yet, it will be seen, cow's milk being deficient in Vit. C and D has to be supplemented with an additional source of Vit. D by way of Cod'Liver Oil, and of Vit. C in the shape of fresh fruit juice (orange juice or tomato-juice). Cow's milk, therefore, survives as the most important basis of artificial food for infants, because, in no other way can a complete diet for an infant be provided so easily and economically as by the use of Cow's milk with added Carbohydrates like sugar and cereals.

Cereals are usually the first solid foods added to the infant's dietary. The age at which they are added varies in different localities, the most frequent age being the 5th month. Apparently the average baby has no digestive disturbances clearly due to cereals at this period at any rate.

The purpose in adding cereals is to teach the child to take solid food and to amplify the protein, the mineral, especially the Iron-intake and Vit. B (antineuritic factor); infact, if the addition of cereals is made at this age (5th month) the margin of safety as to Iron deficiency on milk diet is adequate.

The addition of cereals, moreover, makes the "clotting" of milk in the stomach more flocculent and easily permeable to the digestive juices.

The cereals most commonly used are wheat, oats, rice,

barley, corn-maize and ragi. The cereals used must be the wholeground cereals, so as to retain all their mineral salts and vitamins. The choice of a cereal to be used in supplementing the milk diet is usually dictated by convenience and availability, points to be considered being Iron, Vitamin, Protein and fibre-contents.

The proteins of cereals especially of corn-maize are "incomplete", in the sense that they are deficient in one or more of those amino-acids (like leucine, tyrosine, tryptophane etc.) which are essential for growth. As supplements to milk proteins, however, they are valuable and are utilised. This is of more importance in the diet of the older child, which should contain a much larger proportion of cereals than the infant's diet. The amount of fibre or husk should be sufficient to give a ballast to the bowels but not great enough to produce diarrhoea from irritation. Consideration of these factors indicates that in choosing a cereal those prepared from whole grains are preferable; and since Wheat, Ragi and Oats are the most readily available in most localities these suggest themselves most:

Ragi. Latest researches have shown that Ragi contains a prolamin of high biological value. It is a staple food for a large population of India, especially the poorer and labouring classes and is the premier crop of the Mysore State and the neighbouring districts. It is perhaps the cheapest food grain in the market with a traditional reputation as a nutritious and sustaining food. Feeding experiments have shown that animals maintained exclusively on a diet of Ragi showed considerable increase in weight.

A look at the Table (next page) suggests that each of the cereals noted therein is capable of forming by itself an adequate food for infants when combined with animal protein, as of milk or eggs. But in practice it is advised to combine two or more kinds of cereals in a diet, with the hope that the amino-acids of one cereal may supplement the amino-acids of another cereal.

A mixture of one part of Wheat and two parts of Ragi is commonly used among all classes of our people as an infant-diet after the 5th month. The cereals are cleaned and dried in the sun, powdered fine, mixed and tinned.

Common Cereals with their Average Composition and Calorific Value

	Proteins p. c.	Fats p. c.	Carbo. hydrates p. c.	Ca p. c.	P p. c.	Iron p. c.	Vitamins	Caloric value per 100 grammes
Wheat	12.0	2.0	53 to 70	.054	.315	5.34	A, B_1 & B_2	345.0
Rice (parboiled handpound)	8.5	0.39	77.62	.010	.277	2.75	B_1	348.0
Barley (Indian)	10.0	2.0	60.0	Moderate			A(trace), B(fair)	334.0
Oats	13.5	7.6	63.0	Good amount			B_1 & B_2 (good)	375.0
Ragi	8 0	1.3	76.0	Good amount			A (fair), B_1 & B_2 (trace)	345.0
Maize	9.	5.4	68.9	Fair amount			A & B	82.0

By Analysis one ounce of this powder-mixture contains:

3.30 grammes of protein.

22.0 grammes of Carbohydrate.

0.5 grammes of fat.

and minerals, Ca, Fe and P salts and vit. A, B_1 and B_2 in fair quantity. Now, it has been found by experience that the amount of Protein required for growth is roughly 4 grammes per kilogramme (or 2.2 lbs.) of the body-weight. As the average baby's weight is about 15 pounds at the 5th month he will require about 28 grammes of Protein per day (24 hours). This amount can be supplied from 40 ounces (5 feeds 8 ounces each) of the 2 to 1 Standard mixture of milk (containing pure milk, $\frac{40 \times 2}{3} = 25$ ounces) containing 25 grms. of protein, and one ounce of the Wheat and Ragi mixture containing, as we saw, about 3.30 Grms. of protein.

In preparing the feed with this food-powder mix the food-powder first to a paste with cold water, pour into boiling water on a gentle fire and stir until the gruel is uniform and thick. Next, add fresh cow's milk in sufficient quantity (2 to 4 ounces) and let the whole simmer for 2 or 3 minutes more. Remove from the fire, cool and administer.

Note: For every 8 ounces of the feed are required 2 level Teaspoonfuls of the food-powder, 2 ounces of milk and about six ounces of water. We have seen that the size of each feed at the 5th month is about 8 ounces, at the 6th month it would be about 9 ounces and so on. The food-powder and the amount of milk can be gradually increased as the child grows.

At one year the baby is about 20 lbs. and will require about 35 Grms. of protein per day which can be supplied from 30 ounces of pure cow's milk (containing 30 grms. protein) and one and a half ounces of the Wheat and Ragi mixture containing 5 grms. protein. At the age of 5 months the cereal is given only once daily, but at the age of 12 months it can be given twice daily and the milk could be given whole and undiluted.

It has been shown already under "weaning" that the total quantity of cow's milk given to a baby need not exceed 30 ounces per day.

The usual supplement of Cod Liver Oil and fresh fruit

juice should not however be omitted, as these supply vit. A and D and a certain amount of pure animal fat.

Ordinarily on a pure milk diet or milk diet thickened with cereals the baby's bowels are apt to be constipated. In the case of whole cereals like Wheat and Ragi ground down in their entirety their husk acts as a mild laxative as we have seen.

We, therefore, recommend this Wheat and Ragi mixture in the case of all babies from their 5th month onwards as it is the cheapest, most easily prepared, easily digested and adequate in respect of the mineral salts essential for growth, and when supplemented with fruit juice and Cod Liver Oil the least constipating.

Arrowroot, cornflour, sago are useful forms of starch, which may be given in the form of pudding, but they possess no advantage over rice (especially the hand-pound, parboiled) and it must be remembered that they are practically **devoid** of proteins.

Sources of Vitamins. Vit. C. The anti-scorbutic vit. C as contained in cow's milk is in very small amount and is easily destroyed by boiling. It is contained in various other foods also but to a very little extent. So, in order to ensure adequate amounts the diet must be usually supplemented by some material rich in this vitamin. The substances almost universally used are orange juice and tomato juice. The juices of other citrus fruits are of value also, but either orange juice or tomato juice is economical, as these fruits are available in almost every locality.

Orange juice may be begun as early as the 8th day of birth of the infant in amounts as large as quarter to half an ounce and increased to 3 or 4 ounces by the end of the 1st year. A half-ounce daily is adequate for protection from scurvy for the first two or three months, and after that an ounce is sufficient, though more may be given. Orange juice may be given by itself or diluted with water and sweetened with sugar if necessary.

Fruit juice is a good laxative and antiscorbutic (preventive of scurvy). In Our Tropical Climate Nature yields a variety of fruits rich both in vit. C and nutrient sugars, which do count much in Infant's Dietary. Lemons, sweet-limes and mangoes

have particular seasons in the year. The tropical fruits, papaya, and plantains are in season all through the year; both kinds are rich in vit. C and sugars; papaya contains in addition vit. A and a digestive ferment—papain allied to pepsin of the gastric juice concerned with the digestion of proteins. It is a good liver stimulant and laxative.

Cashew fruits contain a large amount of vit. C, 6 to 8 times as much as is contained in orange fruits, bulk for bulk.

Tender cocoanut-pulp contains good nourishment by way of proteins and fat; its mineral and vitamin content is rather poor.

Other fruits of antiscorbutic value and useful additions to children's dietary are pine apple, sapotas, peaches, pears and apples.

Only expressed juice of fruits is to be given to the baby before he cuts his teeth. If he can chew the best method of giving fruits is to give them raw (uncooked) and cut into small pieces. This gives the baby's teeth good amount of exercise and helps in developing the jaw-muscles also and is a great preventive of dental caries.

Vit. D (*Antirachitic or Rickets-preventing Vitamin*). In the addition of vit. D to the infant's diet, we may make a choice between Cod Liver Oil and the oil from the liver or body of several other fish; but Cod Liver Oil is mentioned first and is recommended as the method of choice for administering vit. D. The objections to Cod Liver Oil or other fish oils are principally their disagreeable odour and taste. If the baby is given Cod Liver Oil from a very early age and it is administered in a firm, calm manner it is usually taken well and tolerated. It seldom upsets the bowels and is less apt to cause vomiting also, once the baby belches. Cod liver oil has the additional advantage of supplying fairly large quantity of vit. A, which may be important as the milk diet is not particularly rich in this vitamin.

The dose used in infant-feeding is half a teaspoonful of the oil twice daily before feeds beginning in the 2nd week and increasing to 2 or 3 teaspoonfuls a day by the age of 3 months. The oil should be kept in a cool, dark place, as heat may cause it to become rancid and exposure to light destroy its anti rachitic potency.

The oils derived from halibut-liver and salmon-liver contain vit. D and vit. A also. The dose of halibut-oil is usually 2 to 4 drops, which is equivalent to $\frac{1}{2}$ to 1 teaspoonful of Cod liver oil. But Cod liver oil is preferred for economic reasons.

Cod Liver Oil need not be given in the hot summer months, when the body is usually getting sufficient vit. A and D from the skin as in the tropical countries, and fat in summer is especially liable to upset digestion.

1. Cow's Milk and its modifications as employed in Infant-feeding

It should again be emphasized that whenever possible breast-milk should be the feed of choice. If breast-milk is not available the usual substitutes are:

(1) Cow's milk, pure or modified in some suitable manner, or

(2) a Dried-milk.

The first thing in feeding with cow's milk or its modification is to make sure that the baby receives a **clean** milk. A suitable dairy should, therefore, be selected and the milk should be derived from a healthy cow. In the house the milk should be kept in a clean vessel, in a cool place and covered with an unventilated cover but not with muslin or net as is the present fashion; and when the milk is finally administered to the baby, attention should be paid for the proper cleaning of the bottles, teats etc.

The second important point is that all milk should be **boiled** before being administered to the baby; and boiling is especially necessary if there is the slightest doubt with regard to the purity of the milk, and certainly for children under 2 years of age, as this is the time at which the dangers of summer-diarrhoea, Tuberculosis etc. are the greatest.

(Even in the so-called Tuberculin-tested milks of the Dairies the danger of the baby fed on such milk catching infection of summer-diarrhoea etc. is not uncommon. Hence even such milk should be boiled before use. Boiled milk is therefore sure to be safe; moreover, boiling makes milk more digestible, as its

casein is so altered by boiling that it becomes more permeable to the digestive juices. In the case of "Dried" milk also the protein becomes more readily digestible.

Boiling, however, has its disadvantages; they are:

(1) Boiling destroys some of the vitamins, such as vit. C from the milk; but this is of no consequence whatever, since the loss can be easily made good by the administration of fresh fruit-juice and Cod Liver Oil.

Boiling for a short length of time actually destroys less vitamin than "pasteurisation," in which process the milk is kept at a lower temperature but for a longer period.

(2) Boiling alters the taste of milk. Adults may often object to this, but babies do not.

(3) A boiled milk is not the **natural** food of the baby as is obtained from the mother. This criticism is unreasonable, as Cow's milk itself is not the normal food of the human baby and should not be taken raw; and meat also is not taken raw.

The disadvantages of boiling are never therefore real and the advantages do certainly outweigh them.

The milk should be just brought to the boil and then cooled rapidly by placing the vessel in cold water. This still further diminishes the risk of destroying the vitamins. The milk should always be **thoroughly cooled before being set aside** for later use, as warm milk being an excellent medium for the growth of bacteria soon turns sour.

Pasteurisation consists in quickly raising the temperature of the milk to 62.5° C (145° F) maintaining it at that level for **half an hour** and then rapidly cooling. If carried out in this way pasteurisation destroys all disease-producing germs including Tubercle bacillus. A convenient Home Pasteuriser consists of a metal cruet or stand on which bottles nearly filled with milk and corked are arranged. The whole is kept in a covered vessel nearly filled with water. The water is brought to 62.5° C and maintained at that temperature for half an hour. This is a convenient method of preserving milk in a safe condition for use on journeys.

(See Fig. 2. Page 207).

2. Modifications of Cow's Milk

In order to understand the principles governing the modifications of Cow's milk for infant-feeding it is necessary to understand the main differences between human milk and Cow's milk. The figures given below are averages, which hold good for all practical purposes.

Composition of Human and Cow's Milks

	Human Milk	Cow's Milk
Protein	1.5 p.c.	3.0 p. c.
Fat	3.5 p. c.	3.5 p. c.
Lactose (milk-sugar)	7.0 p. c.	4.5 p. c.
Mineral Salts		
Calcium	Rich	Extremely rich
Iron	Low content	Excessively low
Calorific value per ounce	20 Calories	20 Calories.

Proteins. Three proteins are present both in human and cow's milk, viz. Lactalbumin, Lactoglobulin and Casein. The total protein in breast-milk is only half that in cow's milk, but the greater part of it is composed of lactalbumen and lactoglobulin with only a small amount of casein; whereas in cow's milk most of the protein is casein with very litte lactalbumen and lactoglobulin. Now, the Lactalbumen and lactoglobulin are very rich in cystine, one of the essential amino-acids and one which is probably of great importance in the growth of the human baby, while casein contains no cystine.

Fat. The fat of breast-milk is in much finer division than that of cow's milk. Further, in cow's milk there are present in some degree certain forms of fatty acids, which have an irritant effect on the bowels. For these reasons the fat of cow's milk is much more likely to give rise to dyspepsia and diarrhoea in children than is the fat of human milk. Infact it is now considered that of the three constituents of milk—protein, fat and carbohydrates—fat is the only one which most commonly causes digestive disturbances, and the white curds commonly seen in the stools of diarrhoea, once supposed to be due to undigested

casein-curds are really soap-curds from unabsorbed fat.

The **Carbohydrate** of milk is lactose, present in both human and cow's milks, but in much larger quantity in human milk than in cow's milk.

Mineral Salts. Calcium is contained in sufficient quantity in both breast and cow's milk, but both are deficient in Iron, and babies fed entirely on milk diet, (especially after the 4th or 5th month) do develop a form of nutritional anaemia (which generally manifests about the 6th or 7th month) and is most easily set right by the administration of cereals or vegetables to milk, or administration of a few grains of any bland preparation of Iron, (Ferri Tartras, Ferri Et ammonii citras or Ferri Et Quininae citras in warm milk or Ferri carbonas saccharatus with honey) twice daily after feed.

A good artificial feed should be such as is digestible and can be produced without any difficulty or much cost. As will be shown presently cow's milk modified in some simple form usually fulfils all the criteria of a good Artificial feed for an infant, though sometimes it is not so sufficiently digestible; but "Dried" milks do fulfil these requirements better than cow's milk modified and in a high degree.

Method of Modification of Cow's Milk

Simple addition of water and sugar to cow's milk in such proportion as to bring the mixture nearest in composition to human milk is perhaps the best method of modifying cow's milk. Cow's milk so modified as to equal or nearly equal human milk in composition is known as "humanised cow's milk" or simply "humanised milk." The adoption of humanised milk as infant's food is found to work very well in practice. The addition of water to cow's milk makes it more digestible, and sugar is added to bring the percentage of carbohydrate (milk sugar) to the required level.

The following is the Standard Mixture though during the 1st month of life a somewhat weaker dilution is usually more satisfactory.

Milk	...	2 parts
Water	...	1 part
Sugar	...	1 level Teaspoonful to every 3 Ounces of the Mixture.

Each feed may be made up separately as above. For greater convenience the total amount for the day may be made up as follows:

Milk	...	1 pint
Water	...	½ pint
Sugar	...	3 level table-spoonfuls.

After preparation the mixture is boiled and cooled and kept covered; the amount required for each feed is warmed up before administration by placing the bottle containing the mixture in hot water.

This mixture is known as the 'Standard 2 to 1 milk mixture.' Prepared as above stated the Standard 2 to 1 mixture will have the following composition. For comparison the composition of breast-milk is also given side by side.

Standard 2 to 1 Mixture			Breast Milk
Protein	...	2 p. c.	1.5 p. c.
Fat	...	2⅓ p. c.	3.5 p. c.
Sugar	...	8 p. c.	7.0 p. c.

It will be evident from the above figures that the composition of the resulting mixture is a bit higher than that of breast milk especially in respect of protein and carbohydrate, but lesser in respect of fat; there is no disadvantage to the baby, because, as shown above, of the 3 constituents, (Protein, Fats and Carbohydrates) fat is the only one, which the baby finds more difficult to digest; moreover, fat is not essential in a baby's diet, provided the baby receives enough calories and vit. A and D in some concentrated form such as Cod Liver Oil and vit. C from fruit juice like orange juice or tomato juice.

Regarding the excess of sugar in the Standard milk mixture compared with the amount present in breast milk it is agreed by Physicians that this extra sugar is generally well-borne by the baby.

Feeding during the 1st Month

A. The Milk Mixture. (Standard 2 to 1 or 1 to 1 Mixture). If the baby at birth is 6 lbs. or over he may be fed with the Standard 2 to 1 Mixture mentioned above; but if the baby's weight at birth is less than 6 lbs. it is usually better to feed him during the 1st month with Standard 1 to 1 Mixture with the addition of the same amount of sugar, as follows:

Milk	...	1 part
Water	...	1 part
Sugar	...	One level teaspoonful to every 3 Ounces of the mixture.

or, for making up the total quantity for the day,

Milk	...	½ pint
Water	...	½ pint
Sugar	...	2 level Tablespoonfuls

Diluents. In all modifications of milk used in artificial feeding, (whether Standard 2 to 1 or Standard 1 to 1 mixture) plain water is the best diluent. Barley water and lime water may, however, be used with advantage. The advantage of barley water is that the colloidal solution of starch makes the curd (formed in the stomach) finer and more digestible; but it is more troublesome to prepare and the uncooked starch might upset the digestion; moreover, if prepared in the morning for the day's use barley water may turn sour before evening. Lime water has no special advantage, because cow's milk, we have seen, is already rich in Ca salts; but it is a useful diluent to the milk in cases of some forms of diarrhoea in the baby.

The Sugar that is used may be Dextrosol, Glucose D, maltose, lactose or cane-sugar. But cane-sugar is the type of sugar chiefly employed. White sugar is satisfactory. Since lactose is the sugar normally present in both breast-milk and cow's-milk it would seem to be the ideal. In practice, however, for some peculiar unknown reason, it is found frequently to be more laxative and fermentable than cane-sugar. Glucose has no advantage over cane-sugar and is costlier also.

Malt-sugar is perhaps the most easily digested and least fermentable.

B. Supplementary diet to the Standard Milk Mixture. (1) In order to obviate the danger from lack of fat-soluble vit. A and D in the Standard milk mixture, Cod Liver Oil or some similar preparation should be given to all artificially fed infants. Cod Liver Oil also supplies some extra digestible form of fat. The dose is ½ to 1 teaspoonful of Cod Liver Oil or 2—4 drops of Halibut Oil, preferably the latter, in increasing doses.

(2) Fruit juice—The amount of orange juice or tomato juice to be given to a baby during the 1st month is 1 or 2 teaspoonfuls (sweetened if necessary) once a day either between 8 and 10 A. M. or before the 6 P. M. feed and may be begun even on the 8th day of birth. It is said, however, that it is not necessary to give fruit juice until after the end of the 1st month except for its laxative effect, as infantile scurvy is practically unknown before the 6th month.

3. How to Calculate the Size of the feed

Two Methods:

A. Calculation by weight of the child. In fixing up the size of the feeds for any baby the following method is used.

Using breast milk as a Standard (at **2½ ounces per pound of body weight, per day**) an equivalent amount of Standard 2 to 1 mixture may be given, since this mixture is approximately of the same caloric value as breast milk. Thus, a 10-lb. baby should receive 10×2½ or 25 Ounces of the Standard 2 to 1 mixture **per day.** If fed four-hourly i. e. five feeds a day, the baby will receive **5 Ounces per feed;** and if fed three-hourly (i. e. six feeds) each feed will be about 4 Ounces.

If during the 1st month the Standard 1 to 1 mixture is used it is advisable to feed the baby on the same principle, that is, at the rate of 2½ Ounces of the mixture per lb. of the body-weight **per day.**

It must be realised that the above Rule is only a rough guide, and the needs of each individual baby must be studied. For example, some babies are hungry and cry a lot and require more food than other babies, which spend most of their time sleeping.

Feeding of very Under-weight Babies

These babies often fail to thrive until they receive a feed more in keeping with what the weight for their age should be, than their actual weight. It is best in such cases to start feeding according to the actual weight; then, if the baby is not gaining weight satisfactorily at this level and its digestion is normal the size of the feeds should be gradually increased to a volume near that appropriate to the weight as it should be for the age. In other words, an underweight baby of whatever age should always be fed in quantities of milk according to the age.

This takes us to another method of calculating the size of the feed, namely by **age.**

B. Calculation of the size of the feed by the age of the child. Rule 1: A baby fed **four-hourly** should receive **per feed** a quantity of milk **in Ounces** equivalent to its **age in months plus 3 Ounces.**

Rule 2: A baby fed **three-hourly** should receive **per feed** a quantity of milk in Ounces equivalent to its **age in months plus 2 Ounces.**

Thus, a baby 3 months old should receive **per feed** 3+3 or 6 Ounces of feed each time if fed four-hourly; and a baby of the same age (3 months old) if fed three-hourly should receive 3+2 or 5 Ounces per feed. In either example the total quantity for the day is 30 Ounces.

Now, if the baby is up to the average weight (of 6 lbs. at birth) this figure (30 Ounces of feed per day) coincides with the amount calculated by the weight of the child; because, we have seen, a baby 6 lbs. at birth should weigh 11 or 12 lbs. at 3 months, and the total quantity of feed in Ounces per day would, at the rate of $2\frac{1}{2}$ Ounces per lb. of the body weight, be $2\frac{1}{2}\times12$ or 30 Ounces.

Whether the baby is heavier or lighter for his age **feeding by weight** is decidedly superior.

Naturally in feeding by **age** the size of the feed has to be increased with the age, and an increase by **half Ounce** each fortnight or **one Ounce** per month per feed is the average

requirement; but the number of feeds are similar to those given under Breast-feeding.

4. Citrated Cow's Milk

If sodium citrate is added to cow's milk the effect on curd formation in the stomach is to render it much more digestible and more like the curd of breast milk. It is added in the proportion of 1 grain to each Ounce of the "**whole**" milk, but the amount added to each feed, whatever the latter's bulk, should not exceed 8 grs., as bigger doses do produce diarrhoea and in some cases a form of anaemia. Citrated milk is used when the baby is unable to take cow's milk modification in the usual Standard 2 to 1 Mixture; and especially when vomiting of curds suggests difficulty in protein-digestion citrated milk may help to remedy he trouble.

The method has the great advantage of simplicity and practically ensuring satisfactory growth and the absence of rickets; the fear that it may produce scurvy has been exaggerated and is not real, as scurvy has only to be met by the administration of fresh fruit juice to infants whether fed on breast milk or cow's milk.

Citrating permits the use of "whole milk" that is, pure undiluted cow's milk.

5. Dried Milk

The variety of dried milk on the market is very large, but all have as their basis cow's milk, which has been dried by some process, either by being poured on to hot rollers or forced out as a spray at a high temperature, the milk falling as a powder, which contains all the original solids of the milk in perfectly soluble form. There are several brands of Dried milk, and when water is added in the strength recommended for each brand they approximate to the Standard 2 to 1 cow's milk mixture or human breast-milk; moreover, it is more easily digestible, its protein having become permanently altered by the heat and its curd much finer than that of raw cow's milk. That is the chief advantage of Dried milk, that it is more easily digestible, the

curdbeing much finer and more olosely resembling that of breast-milk. Moreover, dried milk is necessarily purer and freer from bacteria than raw milk. The nutritive value of dried milk is fully equal to that of ordinary milk. Dried milk is a handy article of diet for a baby on journey or voyage.

Dried milk, however, is not without its disadvantages, they are:

(1) Loss of vitamins—The process of drying entails a loss in vitamins, but it is only to a very slight extent and can be easily made good by the routine administration of Cod Liver Oil and fresh fruit-juice, as we saw. Roller-dried milk loses very little of vitamins.

(2) Dried milk is said to be an unnatural food; so also is cow's milk; and cow's milk is not taken raw and should not be taken raw.

(3) Expense—Dried milk should certainly be expensive, and expense is a great thing in the case of the poor.

Preparation of Dried Milk as Food. The usual strength recommended by the manufacturers is 1 in 8, that is, one level measure or scoop supplied with the bottle or tin or one heaped teaspoonful to one Ounce of water; and the size of the feed is usually the same as of the breast-milk or Standard 2 to1 milk Mixture as judged by the weight of the baby which means that 2½ Ounces per lb of the body-weight per diem should be given.

6. Proprietory Foods

In judging of the value of these numerous preparations one may divide them into the following classes.

I. Foods prepared from cow's milk with various additions or alterations, requiring the addition of water only to be ready for use.

Examples: Allenbury's No. I and II, Neave's Malted Food Horlick's malted milk, Milo-food, Carnricks Sunshine Glaxo etc. Most of these are comparatively richer in carbohydrate and poorer in fat than humanised milk. But their essentialconstituent is dried milk, to which malt sugar, malted flour etc. have been added. They are easily digestible and are therefore

well borne by delicate infants; but their poverty in fat renders them unsuitable for prolonged use. They are often not free from the risk of producing scurvy, but this danger need not be feared if their administration is confined to the first three months of life, and if sufficient dose of Cod Liver Oil and fruit-juice are given in addition.

II. Foods prepared from cereals such as wheat, of which the starch has been transformed into malt sugar or Dextrin. These require the addition of cow's milk to fit them for use. E. g. Mellin's Food is a completely malted food, practically a desiccated malt Extract. Benger's Food, Savory and Moore's, and Mosley's Food do all contain either malt or pancreatic ferment, which converts the strach when the food is mixed. Most of these proprietory foods are deficient in fat, protein and mineral salts, and if mixed with water only can never be true substitutes for human milk. Hence the addition of fresh cow's milk, atleast 2 Ounces per feed, is necessary. These foods are chiefly of use in supplementing the diet in infants who are unable to digest cow's milk. The addition of these foods to cow's milk renders cow's milk more digestible probably by acting mechanically on the curd formed in the stomach as barley water, Oatmeal, rice gruel or any cereal starch does.

These foods are useful additions only after the 6th month.

It is undoubtedly better in the case of young infants to use a food such as Mellin's, in which the conversion of the starch has been completely carried out in the process of manufacture.

III. Foods containing unaltered starch from cereals. E. g. Neave's, Sister Laura's, Chapman's Whole Wheat Flour, Robinson patent Barlely and groats and others. Now strach forms no part of the diet of a naturally fed infant until at least after the cutting of some of the teeth; and presence of unaltered starch in the diet of the young infants is prone to excite disorders of the stomach and bowels. A consideration of these facts renders it evident that foods belonging to this class should be avoided altogether before the infant has cut any teeth. Their addition to the diet after that period will undoubtedly furnish the child with an increased amount of protein and carbohydrate, but such

articles as toast, bread, Oatmeal and rice will do so quite efficiently, are easy of digestion and have the practical advantage of being very much cheaper.

7. Thickened Feeds

1. These are useful in certain conditions associated with vomiting and also in underweight babies who are not putting on weight satisfactorily on milk modifications alone. Savory and Moore's or Benger's may be used in such cases, and the feed is prepared thus:

Cow's milk	...	1 pint
Water	...	½ pint
Sugar	...	2 level table spoonfuls.
Savory & Moore or Benger's		2 level table spoonfuls.

Mix the food powder with a small quantity of cold water and make into a paste; pour on this the boiling milk, water and sugar. Allow to stand for 30 minutes and then bring to the boil again; cool.

2½ Ounces of this mixture should be given per lb. weight of the baby per diem.

With this diet, however, Cod Liver Oil and fruit juice should also be given as with any other diet. Of course the Cod Liver Oil may be temporarily suspended if it is not well borne by the baby, and restarted in small doses when the vomiting has ceased.

2. Thickening with **oatmeal** can be done for feeding infants over 3 months. The mode of preparation of the feed is the same as above. Only oatmeal is substituted for the Savory and Moore or the Benger. With oatmeal, however, a greater degree of thickness is obtained. The mixture is prepared similarly and with the same quantity of the ingredients but should be boiled directly for 20 minutes stirring all the time.

Note:-In feeding with the so-called thickened feeds or similar mixtures it is **absolutely imperative** to give Cod Liver Oil and orange juice, as otherwise rickets and scurvy are extremely likely

to develop. The infant has to be fed with a spoon when the thickened feeds are given, as the mixture is too thick to pass through the holes of the teat with ease.

3. Groats are "ground-oats" from which the outer cover is removed. It is better than oat meal and is full of proteins and mineral salts.

4. Arrow-root, corn-flour and sago, we have said, are also useful forms of thickeners and may be given as puddings, but as they are nearly all starch with no proteins or salts whatever they are much inferior to rice, which as parboiled hand-pound rice contains not only proteins, but mineral salts and vitamins B_1 and B_2 most necessary for growth and for helping the assimilation of Carbohydrates.

5. The Wheat and Ragi powder mixture is perhaps the best means of thickening the feed and forms an ideal diet for infants containing as it does especially when combined with cow's milk the proper amount of adequate proteins, fat, carbohydrate, salts and vitamins B_1 and B_2 and when supplemented with Cod Liver Oil and fresh fruit juice vit. A and C and vit. D, and a small amount of easily assimilable form of animal fat also, and is on the top of it the cheapest and most easily prepared food. These advantages should certainly justify its universal adoption as an infant-food in a poor Country.

Summary: It may be convenient here to sum up certain Rules for guidance in infant-feeding.

1. Breast-feeding is always to be preferred as the so-called modified or humanised milks are no perfect substitutes for breast-milk.

2. If the baby does not gain weight or loses weight on the breast-milk, try mixed feeding, using breast-milk along with modified cow's milk.

3. If breast-milk is inadmissible a healthy infant may be reared on pure sterilised cow's milk with the addition of citrate of sodium if necessary. But a feeble infant will require modified cow's milk.

4. The simplest modification of cow's milk is the Standard 2 to 1 milk mixture or the Dried-milk mixture,

5. Proprietory Foods should be avoided as complete foods if fresh milk is obtainable.

Care should be taken that the infant's food contains adequate amount of Carbohydrates, proteins, fats, mineral salts and vitamins B_1 and B_2 and antirachitic A and D, and anti-scorbutic C. These latter are supplied only by means of fresh milk, Cod Liver Oil and fresh fruit juice. All these requirements of a perfect food for infants are fulfilled adequately by the Wheat and Ragi mixture already described. Yet we see thousands of money are being annually spent on foreign Proprietory foods to procure for our children a rickety constitution with its liability to diseases of the lungs and the liver. Evidently cheap food is no food in the peoples' opinion.

6. The child should show satisfactory gain in weight, say 4 Ounces every week, he should appear satisfied, of good cheer, his muscles active and well-formed. When all these points are satisfied then there is justification to say that the baby is adequately and properly fed.

8. Schemes of Dieting Infants

TABLE I

Breast feeding.

1st Day A teaspoonful of warm water with a trace of sugar, given every few hours if the baby is awake. Put the baby to breasts once in 6 hours for a few minutes each time. This is to teach the baby to "suck" and also obtain some colostrum, which might do him good. Sucking is a stimulus to secretion of milk also.

2nd Day Baby put to the breasts every 4 hours for a few minutes each time.

3rd Day Usually by the 3rd day milk is fairly well secreted by the breasts and the baby is fed thus.

If there is not proper secretion of milk. but the baby is not crying with hunger or is not restless it is sufficient to give some warm water with a trace of sugar after the baby has been put to the breast. The feeding is 4 hourly and only for a few minutes.

But if the baby is crying and the amount of breast milk is insufficient then give the baby a small complementary feed after he has been put to the breast. The feeding is 4 hourly also and for a few minutes.

A suitable complementary feed would be one or two Ounces of cow's milk diluted with an equal amount of water and a trace of sugar, boiled and cooled.

4th Day to the end of the first month. Generally there is proper secretion of breast-milk. Put the baby to the breasts at 4 hourly intervals, i.e. at 6, 10, 2, 6 and 10, or 7, 11, 3, 7 and 11 o'clock, if the baby is of normal weight of 6 lbs. at birth or more. If the baby is, however, below average weight then put to the breasts at 3 hourly intervals, i. e. at 6, 9, 12, 3, 6 and 10 O'clock, or at 7, 10, 1, 4, 7 and 11 O'clock. Half Ounce of orange juice once daily at 4 p. m. and half a teaspoonful of Cod liver oil daily after the 11 O'clock and 7 O'clock feeds.

II month III month IV month	Breast milk at 4 hourly intervals. Half Ounce orange juice once daily gradually increased to one Ounce, at 4 p. m., Half a teaspoonful of Cod liver oil gradually increased to 3 teaspoofuls twice daily after the 11 O'clock and 7 O'clock feeds.
V month VI month VII month VIII month	Breast feed—7 a. m. Thickened cow's milk, with cereal (Wheat and Ragi) at 11 a. m. Breast feed 3 p. m. Thickened milk with cereal (Wheat and Ragi) at 7 p. m. Breast milk—10 or 11 night. Cod liver oil and orange juice to be continued.

IX month—The baby should be weaned.

TABLE II

Artificial Feeding. (1st to 8th month)

I Month (Average weight 7 lbs.)	Standard 2 to 1 milk Mixture if the baby is of normal weight of 6 lbs. at **birth.** Fed at 4-hours intervals. If the baby is below normal weight

he can be fed with Standard 1 to 1 milk mixture and at 3-hourly intervals. Each feed is about 4 Ounces.

2 to 4 drops of Halibut Oil or ½—1 Teaspoonful of Cod Liver Oil—twice daily after 11 O'clock and 7 O'clock feeds.

Fruit-juice—2 Teaspoonfuls or more once daily about 4 P. M.

II Month (Av. wt. 9 lbs.) 4-hourly feeds of the Standard 2 to 1 Milk Mixture; each feed about 5 Ounces: Cod Liver Oil 1-2 Teaspoonful or 4—6 drops of Halibut Oil as before after the 11 O'clock and 7 O'clock feeds. Fruit-juice—Half Ounce once daily.

III Month (Av. wt. 11 lbs.) 4-hourly feeds of the St. 2 to 1 M. M.—each feed 6 Ounces.

Cod Liver Oil 2—3 Teaspoonfuls or 6—8 drops of Halibut Oil twice daily after 11 O'clock and 7 O'clock feeds.

Fruit-juice—Half Ounce—once daily.

IV Month (Av. wt. 13 lbs.) 4-hourly feeds of the St. 2 to 1 M. M.—Each feed 7 Ounces.

Cod Liver Oil and Fruit-juice the same or slightly increased at the usual hours.

V Month (Av. wt. 14 lbs.)
VI Month (Av. wt. 15 lbs.)
VII Month (Av. wt. 16 lbs.)
VIII Month (Av. wt. 17 lbs.)

(1) Pure cow's milk or citrated milk, 3 feeds of 5 Ounces each, at 7, 3 and 11.
(2) 2 cereal feeds with 3 Ounces cow's milk each feed—at 11 A. M. and 7 P. M.
(3) Cod Liver Oil—twice daily after the cereal feeds.
(4) Fruit-juice—once daily—4 P. M.

The total amount of cow's milk given per day need not exceed 30 ounces.

9 to 12 Months

7 A. M. Cow's milk, pure or citrated—4 to 6 Ounces.

11 A. M. 4 Ounces cow's milk thickened with cereals, made up to about 8 Ounces, Cod Liver Oil, 1 to 2 Teaspoonfuls or 8—10 drops Halibut Oil.

3 P. M.	Warm milk—4 or 6 Ounces.
	Orange or fruit juice—half ounce.
7 P. M.	4 Ounces milk thickened with cereals—(about 8 oz. in quantity)
	Cod Liver Oil ½ –1 Teaspoonful.
10 P. M.	Warm milk 4 or 6 Ounces.

During this period the use of the bottle should be discontinued and the child fed with a spoon or accustomed to drink from a cup. The amount of milk taken in the course of the day should not exceed 30 ounces. If the child is thirsty a little water (Boiled and cooled) between meals may be given.

From about the 10th month onwards, when the baby has cut a few teeth something to chew should be given occasionally so that his teeth and jaw muscles may get strengthened.

* * * *

The following are the rations recommended for children of 1 to 5 years of age by the Technical Commission of the Health Committee of the League of Nations in their Report published in 1935:—

I. The daily rations for a child aged 1 to 2 years are as follows:

	Milk	30 Ounces
	Egg	one
or	meat, fish or liver	one Ounce
	Green leafy vegetables	one or two Ounces
	Potato and other root vegetables	one and a half Ounce
	Cod liver oil	3 drams
	Raw vegetable or fruit juice	one Ounce
	Cereals or bread	1½ Ounces
	Butter	¼ Ounce.

II. The daily rations for a child aged 2 to 3 years:

	Milk	30 Ounces
	Egg	one
or	Meat, fish or liver	one Ounce
	Green leafy vegetable	2 or 3 Ounces
	Potato and other root vegetables	3 Ounces
	Cod liver oil	3 drams

Raw vegetable or fruit juice	1 or 2 Ounces
Cereals or bread	3 Ounces
Butter	¼ ounce.

III. The daily rations for a child aged 3 to 5 years:

Milk	30 Ounce
Egg	one
and Meat, fish or liver	one Ounce
Green leafy vegetables	3 Ounces
Potato	3 or 4 Ounces
Cod Liver Oil	3 drams
Raw vegetables and fruit	2 Ounces or more
Cereals or bread	4 Ounces
Butter	½ Ounce

Note: In the above dietary wheat bread can be replaced by rice or ragi in quantities one and half times that of wheat. Regarding potatoes the same is recommended to replace part of the starch of highly milled cereals in the ordinary diet. Potatoes provide extra vit. C and more readily available Calcium and phosphorus than are present in cereals. Potatoes also yield more Iron and vit. B than milled cereals. Where potatoes are not abundant or do not form the staple diet an equal weight of rice or ragi plus half the weight of pulses or legumins may be substituted.

* * * *

Hence, between the ages of 1 and 2 years the infant may be given solid food, such as cereals with milk, boiled rice, eggs, nuts and fruits and vegetables.

A child's natural instinct craves for fruit, and the value of this natural foodstuff is not properly recognised. So stupid are parents sometimes that instead of allowing fruits as a regular and integral part of the daily diet of the child, mothers give them as a treat or reward for good behaviour. Children should have fruits as a matter of course. A hard fruit to chew is excellent for the teeth, has a cleansing effect and gives exercise to the jaw muscles and prevents deformity of the face resulting from disuse of the teeth. A piece of bread is equally useful in this respect.

The feeding of boys and girls of school-going age, that is,

from 6 years onwards to the age of puberty needs knowledge, for at this period the young body is developing rapidly and needs the best kind of food.

In most of the Boarding Schools the children are half-fed and have many a time to supplement the scanty school rations by eating at odd hours at hotels, a most pernicious habit among the school-going folk.

A growing child studying hard, taking active part in the school games needs necessarily as much food as a hard working adult. The sooner the School Authorities recognise this, the better, and then we should not see so many pallid girls and pasty faced boys about.

The school boy and school girl should be allowed a generous diet consisting of enough of protein, like bread, oatmeal, eggs, milk etc. and enough of fruits and vegetables, and encouraged to drink plenty of water, not with meals but between them and when thirsty. 5 or 6 glasses a day for a child is not too much in our climate. Fruits and water eliminate the waste products from the body by keeping the bowels and urine regular.

Constipation is the parent of many ills and must be carefully avoided. Children often get so absorbed in their play that they will not spare the time to visit the privy and so they often get ill.

Most children are not accustomed to tea or coffee and there is no reason why they should be given these beverages of the grown up adults. They are apt to upset the nerves and coffee especially will cause the liver to be upset. Even cocoa if taken too frequently like too much of anything else upsets the stomach.

Alcohol certainly is not indicated even in adults, and more so in the case of the young.

Rich dishes and elaborate sauces are not to be allowed to children, as they are apt to over-stimulate besides upsetting the stomach and the liver. There is still time for them to enjoy the delicacies when manhood or womanhood is reached after surviving the critical school age.

The common practice of forcing the child to eat food which

he obviously does not relish is senseless and there cannot be a greater mistake the mother commits, as food which he heartily dislikes cannot be agreeable to him; and the feelings of resentment aroused by the mother's cruelty are quite sufficient to cause digestive disturbances in the child. In fact no child should be forced to eat if he is frightened or in a rebellious mood. The emotions have an effect on the digestion just as much in children as in adults and those parents who refuse to recognise this important psychological principle can be said to be real tyrants.

Luckily our present day mothers are more enlightened regarding the care of the child, and the unkindness often amounting to barbarity which disgraced the past generation is abhorrent to the modern mind.

On the other hand the other extreme practice of letting children eat anything they fancy is equally dangerous as the appetite of the youth often takes odd forms.

* * * *

So far we have been dealing with the normal infant, born at full term of pregnancy and fully developed physically and functionally. We shall now pass on to the premature-born infant

VII. Care of Premature Infants

Infants born 3 weeks or more before the expected time of delivery can be termed premature; such infants do as a rule show certain peculiarities due to interrupted development while in the womb. They are naturally lesser in size and weight than babies born at full term of pregnancy. Exceptions may be noted in twin-pregnancy, when the infants are many a time smaller in size but functionally mature.

Premature babies, it must be remembered, are undeveloped in every way and are not prepared to live outside the uterus. In the uterus these infants are surrounded by warm, sterile fluid and protected from outside chill or injuries; their body needs are cared for with little effort of their own organs: In fact from a state of inactivity and maternal protection they are suddenly removed into conditions which at best are hazardous to premature infants; their organs especially the Lungs, the Heart

and the Digestive organs are not ready at the time of birth to perform their functions. Likewise the function of heat regulation is inadequate. The body is flaccid, movements are infrequent, cry is weak and feeble, sleep almost continuous and the infant has to be constantly roused even **during the course** of his feedings. Sucking power may also be weak. Skin soft and red, blueness of the face and the extremitis, respirations are weak and irregular as the air-cells of the lungs may not have properly opened out.

As a rule premature babies are short-lived, but can be brought up with timely precautions and proper care.

The smaller the infant the more uncertain will be the first few days or weeks of life, especially if there should be congenital syphilis and injuries received during birth or acute infections of the infant.

Premature infants do usually sit and walk at a some-what later period than those born at full term. The development of rickets and anaemia is almost certain to occur in the majority of premature infants unless early and effective measures are employed. One thing is certain, that given the advantages of modern precautionary measures it may be said that after the II or III year at the latest premature and full-term children cannot usually be differentiated.

Prematurity is a serious condition and these infants are apt to die suddenly without any apparent cause. It is not therefore safe to consider them to be out of danger unless they are thriving under normal conditions. The opinion whether a premature baby will survive long depends upon his weight at birth and also upon the care bestowed on him. Infants whose weight at birth is 3 lbs. or less are very difficult to rear; the ability to nurse well and swallow combined with muscular activity, and a forceful cry are favourable signs. A sub-normal temperature is a bad sign and lack of immediate care at the time of birth to prevent "chill" may be the cause of this low temperature. Hence all care bestowed on the immature infant must be carried out in detail to achieve favourable results.

Management: Preparations for a premature birth are

necessary in order to prevent chilling of the infant after birth and if anticipated the preparations should not be delayed until labour has begun and everything that is needed for conducting an aseptic delivery and for the immediate care of the infant should be in readiness. Whenever possible the delivery should be conducted in a hospital, where adequate facilities for the care of the premature infant are available. Warm sterile blankets and a warm bassinet should be in readiness to receive the baby.

The care ot the premature baby soon after birth is practically the same as the care of the normal infant, but with certain additional precautions, viz., extreme gentleness, strict asepsis and prevention ot exposure; soon after the cord has been cut the infant has to be wrapped in warm sterile blankets and placed in a warm bed. The eyes and cord are cared for, and the first bath is given only after respirations and temperature have come up to the normal.

The important care of premature infants is - maintenance of the normal body-temperature, and is accomplished by means of proper clothing and warm surroundings. A 'guddadi' made by loosely quilting several layers of cotton between gauze or flannel is extremely warm and light, and the infant can be conveniently wrapped in this. A warm bed can be easily made by thickly padding with cotton-wool the sides and bottom of an oval basket or bassinet and placing a heavy blanket over the top extending upwards to the infant's face. The bed can be maintained warm by placing hot water bottles.

The daily care of these infants requires a certain amount of intelligence and skill and may be secured in a private house by employing the services of an efficient nurse experienced in the care and feeding of infants.

Feeding: Here again breast-milk is more suitable than cow's milk. For this reason every effort should be made to assure a constant and adequate supply of milk from the mother. Her mode of life should be regulated, her diet properly selected; she should be spared from worry and excitement and should have an adequate amount of sleep.

As the milk is not usually established in the breasts before

the 4th day, until this time it is advisable to obtain breast-milk from some other source, and when it is obtained from any other source it should be sterilised before being given to the infant. If the infant is strong enough to suck he may be put to the breasts every 3 hours for 5 or 6 minutes. Care should particularly be taken that the infant during feeding is properly wrapped up to prevent exposure.

If the baby is not able to suck milk some form of feeding bottle which is not "hard" to suck may be employed, or the baby may be fed with "dropper" or thin muslin wick kept moistened with breast-milk as is the prevalent fashion.

As a rule it is better to begin the feed with small amount, and gradually increase each day as the infant becomes stronger and more active. Additional fluid in the form of boiled water given warm and sweetened with about 20 grs. of dextrose or lactose to every Ounce may be given until the breast-milk sufficiently forms.

In the absence of breast-milk any sort of Dried-milk or malted milk like Horlick's, Glaxo, Mellin's Food etc. may be given in quantities of 2 or 3 Ounces each time at 3-hourly intervals or more frequently.

As soon as the infant has gained sufficiently in weight and strength he should nurse the breast. Adequate amount of vit. A and D and vit. C should be supplied to premature babies at a very early age; it is recommended that Cod Liver Oil may be started during 1st or 2nd week (one teaspoonful daily given in divided doses, gradually increased to even 4 teaspoonfuls a day by the end of the 3rd month), and orange juice also about the same time (in doses of 2 or 3 teaspoonfuls once daily about 4 p. m.).

VIII. Child Hygiene

The Protection of the health of children from birth through the school-age is termed "Child Hygiene." The fact that 25 p. c. of all deaths in a community occur before the age of 5, and that the majority of them occur before the age of 2 emphasises the importance of child hygiene. In all Cities there have been established Institutions for the care of infants and for the instruct-

tion of mothers in such questions of child welfare as feeding etc., for it is known that the most active cause of infant-mortality is the ignorance of the mothers. Only education in this respect can remedy this defect.

The health of school children is also generally coming under the supervision of competent medical men and women. The poorly ventilated and over-heated stuffy rooms found in many houses, the crowding in the house of the poor, insufficient and often unprotected food, irregular and improper feeding, over-dressing of infants, both in warm and even in cold weather and the use of drugs and pacifiers are the commonest predisposing causes of most of the ills of children The encouragement given to mothers to nurse their babes, the inspection and teaching of hygienic principles by visiting nurses, the improved milk supply and propaganda on child hygiene have done much to reduce infant mortality in the Cities; and the instructions in Domestic Science given in public schools is a most promising work in this direction.

The Medical Inspection of school children by which defects of Nose, Ears, Eyes, Throat, Teeth and other physical defects are detected, the establishment of play grounds, the proper ventilation and sanitation of school-buildings and the care in preventing constitutional and Infectious diseases among children have immensely contributed towards child-welfare.

[The principles governing child hygiene do not differ very much from those governing adult hygiene except in certain special respects; the reader is therefore referred to the chapters on Adult Hygiene also].

1. Teeth and their Care

Care of the teeth is essential, and parents who neglect their children's teeth are deserving of the severest censure, as bad teeth mean not only digestive troubles in the young but lead to all kinds of trouble in after-life. When the teeth come they should be perfect and this can be secured only by proper attention to them in childhood. Neglect, uncleanliness and bad dietetic habits are responsible for defective teeth.

Few people believe that the child is born with teeth. Such is the case, but they are not visible being buried in the gums, and there are 20 of the tiny teeth already with crowns and covered with enamel, It is when they begin to force their way through the gums that the trouble begins and the baby is said to be "teething." Usually at the 6th month, the teeth (milk teeth or temporary set) begin to appear if the child is healthy and has been properly fed from birth. The two lower central incisors come first as a rule, then the upper two central and two lateral incisors. Thus a 12 months child should have 6 teeth, an 18 months child should have 12, and a 24—months old child 16 teeth and a 30 months child 20 teeth, as per the following list:

At	12 months	...	6
	18 months	...	12
	24 months	...	16
	30 months	...	20

Some babies begin teething later, some begin earlier than the 6th month. But if a baby's teeth have not appeared at the age of 12 months rickets should be suspected. Now, rickets is due to improper feeding, or "malnutrition" as it is called. Artificial foods if not selected with care are apt to bring about rickets; but the antenatal conditions have as we have seen, much to do with its prevention, and if the expectant mother is nourished on the right kinds of food and lessens her rations of starches and sugars there is no likelihood of rickets developing in the child.

The time at which children begin teething varies immensely even in the same family, one child of a mother may cut at the 4th month, while another child of the same mother may not cut teeth even at 12 months. But this is by the way; what we desire to impress on the mothers is that a baby's teeth are made or marred by the foods which are given to him during the first six months of his life. The breast-milk of a healthy mother is the finest thing for an infant and no efficient substitute has yet been invented.

It is perfectly apalling to see the kind of food on which some children are fed after they are weaned. Soft, pappy stuff which gives the little teeth no chance to grow firm and strong.

Such food is responsible for more defective teeth than anythig else in the world. The little teeth require exercise and they want something to dig into and pull at, such as pieces of bread, a hard crust, a slice of raw (unstewed) fruit and a tough pappadam; and soft food that slips down easily most obviously cannot give the required exercise to the teeth. This kind of neglect lays the foundation of caries and many other of the teeth-evils.

The muscles of the jaw suffer too when the teeth do not obtain sufficient exercise. Muscles which are not used fail and atrophy. These deformities begin in the lower part of the face which may persist through life and be a source of constant unhappiness.

It must be impressed here that defects of the teeth and the face brought about by carelessnes in infancy and childhood are easily transmitted to the next progeny of the defectives and come to be established in them for want of a little timely care on the part of the mothers.

Caries of Teeth. One cause of bad teeth in children is the sugar habit. The excessive use of sugar is responsible for much of the caries which affect the present generation; sweets and chocolates are evils to the teeth. A certain amount of sugar is of course necessary in our diet as it is a heat-producer, but it can be obtained in other form than as sweets; all fruits contain sugar in its natural, safe and most assimilable form, and fruits like the dates, figs, raisins, mangoes, papaya, plantains etc. are not only sweet but are useful in correcting chronic constipation. Chewing of sugarcane by children or adults not only gives them natural fruit sugar, but the fibrous nature of the cane serves as a cleanser of teeth, and the exercise of the jaws necessary to render it pulp stimulates a flow of saliva, which also keeps the teeth clean.

Sugar added to children's food causes nausea and indigestion at first, but they soon get used to it and begin to like it, and then crave for it like the smoker and the drunkard for their particular vices.

Often we see the teeth are hopelessly decayed even at 15 months and on enquiry it is the same story repeated—"sucking

comforters dipped in honey or sugar, or a sugar bag in the mouth on going to sleep."

Deformities of the jaw. "Baby-soothers" or "comforters' are, we said, dirty and dangerous carriers of dirt and infection of disease. They are also potent factors in causing malformation of the mouth and the jaw. In France, it is said, they are forbidden by law and similar legislation ought to exist everywhere. The use of the soother induces flatulence or other internal distress.

Usually a child cries when it is uncomfortable in some way, either through indigestion, colic, wet clothing or perhaps prick of a pin used to fasten the clothes. Instead of trying to find out the real cause of the weeping careless and ignorant mothers do pop a comforter into the child's mouth and thus a habit is formed the child gets used to the "horrid" thing and subsequently cries for it. "Far better were it" says Webb Johnson "to suck a juicy bone from which the meat has nearly disappeared, or a tough crust of dry bread has its uses. Allow the child to do this, the jaws are exercised and the baby kept quiet and amused. Care however, must be exercised if the child is inclined to be rickety, the bones of the jaw being soft may become distorted."

"In a healthy child the bones are hard and not likely to get out of shape. We are too familiar with the spectacle of some unhappy person with no chin to speak of and projecting upper teeth. This is very likely the result of the use of a comforter in baby-hood. These people may thank their careless and ignorant mothers and nurses for their unprepossessing appearance."

Teething troubles would be unknown in the case of a perfectly healthy child; but unfortunately few babies are absolutely healthy and a certain amount of fever or vomiting or diarrhoea or all these combined may make an appearance during the time of teething. Often these symptoms show themselves when the baby's feeding is changed from the breast to the bottle at the weaning period, which is usually about the 10th month and mothers often wrongly ascribe the symptoms to "teething."

At about the 6th year the first permanent teeth begin to appear. If good habits as regards mastication of food have been formed in the young child the teeth are not likely to decay.

It has been observed that when children have repeated attacks of toothache their resistance power against disease is lowered and the general health becomes consequently impaired; such children are subject to constant attacks of fever and cough and are greatly prone to develop adenoids, tonsillitis and other forms of obstruction to breathing, which in their turn predispose the young growing child to Tuberculosis. Adenoids and tonsils of course require removal by surgical operation.

It has been well said that children have no business to have bad teeth, for Mother Nature provides them with a good set of teeth to start with. This is one of the ways of Nature of seeing to the survival of the race. When we come into the world we immediately begin to spoil our teeth either by improper food or foolish habits of eating food.

Apart from eating dry and tough foods children should be encouraged to masticate thoroughly. This not only gives the teeth some work to do and keeps them hard and healthy but prevents indigestion caused by rapid 'bolting' of the food, humourously compared to "posting letters." "Learn to eat slow, all other graces will follow in their proper places" is the old saying.

One of the causes of bad teeth is "rickets." "Now, rickets" is a "deficiency disease" i. e. it is due to a lack of certain important elements, Ca salts and vit. A and D in the diet. The bones are softened so that the leg bones bend under the weight of the child's body when the child has begun to walk, causing "bow-legs" or "bandy-legs" popularly known and other deformities. It is on account of the presence in them of Ca salts that our bones are hard; and when the Ca salts are not present in the bones they become soft and easily deformed. Rickets has therefore to be combated before the bowlegs and other peculiarities manifest themselves. Proper diet can alone accomplish this end, not drugs, i. e. foods containing the essential vitamins and the Ca and P salts should form the diet, also any foods containing fats, cream, milk, butter and fat-meat; Cod Liver Oil is also very useful if the child can take it; fresh air and sunshine are extremely helpful in fighting the disease.

Much can be done to prevent rickets in the coming child by proper care of the expectant mother both during pregnancy and during lactation. It is a significant fact that three quarters of the cases of rickets occur in babies brought up entirely on artificial or proprietory foods. Often "infantile scurvy" also accompanies rickets in such cases.

To summarise. The causes of defective teeth are several.

1. Rickets is the most important and may be successfully fought by a proper diet containing the requisite vit. A and D and Ca and P salts.

2. Another cause is insufficient mastication of food through the child not being taught to chew his food thoroughly. The use of soft mashy food which does not necessitate exercising the teeth and the muscles of the jaw is also a common cause. Pastry foods, Biscuits and Sweets ferment easily in the mouth when left between the teeth and the acidity so produced tends to corrode the teeth resulting in their caries.

To have good teeth all that the child has to do is, as Webb-Johnson says "to teach its parents to feed it on articles that give the jaws plenty of exercise, and not those that slip down without the trouble of chewing."

The teeth should be brushed every morning and preferably in the evening also with warm water and a good tooth powder or paste. Rinsing the mouth with a saturated solution of common salt is a useful method of cleaning the teeth when the gums are tender and bleeding as brushing is then painful. The salt solution has great penetrating power and reaches even the remotest crevices under the gums and has a curative effect on the sores under-neath. Salt also neutralises to a certain extent the acidity of the fermenting food remnants between the teeth.

The following verses extracted from "The Children's Encyclopaedia" contain a valuable health lesson:

If you want to be happy
And quick on your toes,
You must bite your food slowly
And breathe through your nose.
You must press back your shoulders

And hold up your head
And not close your windows
On going to bed.
You must think what is noble
And do what is kind;
You must strengthen your body
And tidy your mind.

(*After Webb-Johnson*).

2. Cleanliness

The child must be bathed with warm water and soap at-least once daily in the tropics both for comfort as well as health; the body should be washed well quickly to avoid exposure. The soap should be of delicate scent, as strong scented soaps are rather irritating to the delicate skin and the nose. The use of sponges should be avoided as they are not easy to clean, and everything connected with the child's toilet should be perfectly clean.

Warm water is a better cleanser than cold water. Cold baths are as a rule to be avoided in the case of infants especially the weaker ones.

A child old enough to bathe himself should be taught to look upon bath as a daily habit. The genital organs should be the object of particular care, for if they are neglected irritation is caused and abuse may follow. This is an important item in the personal hygiene of the child.

Cleanliness of the person cannot be maintained without due attention to clothing worn both during day and night.

3. Clothing

Since we have to wear clothes we might as well use some care and commonsense in their selection. Very small children should be kept warm at all costs and never allowed to be chilled, as a chilled baby is often an ill baby and may soon be a dead baby. Too many innocents are massacred every year by careless mothers allowing them to be chilled. A baby's clothing should be loose and the use of tapes and fasteners is to be avoided as

far as possible; as they are often the cause of constipation in children. Everything worn by the baby should be perfectly clean and free from smells, as skin irritation and minor complaints are caused by lack of cleanliness.

The times when little children were dressed up like small courtiers of their mothers have happily gone, says Webb-Johnson, so also are the times when silly mothers who liked to think themselves very artistic, dressed their little girls in picture frócks and asked if they did not look sweet. They may have looked sweet, but, he says, the long heavy skirt prevented the free movements of the hip and also kept away light and air from the body. Overclothed children are apt to catch cold. Some children are never free from cold in the winter, a condition due to too much of clothing; because they lose heat quickly by radiation or evaporation; and undüe deprivation of clothing may have injurious effects upon children, who require a large amount of heat to carry on the processes of growth and development. A child has only a limited amount of vitality available for the functions of breathing, digestion and circulation and if an undue amount of this vitality is spent in the maintenance of heat the other functions will suffer with the result that digestion is weakened and that constipation results. Infantile diarrhoea and dysentery is often the result of exposure to wet or cold, and doctors usually advise mothers of children affectod with diarrhoea or dysentery to put on a warm flannel bandage to the child's abdomen.

The clothing should be soft, light, warm and loose and should be so arranged that it can be easily taken off. Every garment should be made to fasten with tapes and buttons. Pins are dangerous and have been known by their irritation to have driven young children to excessive crying and convulsions.

Modern science, however, has shown the immense value of sunlight (ultra violet rays) to the growing child, and it is possible that we overcover ourselves and with too much of clothing. Mellanby, for instance, has pointed out that the freedom of the dark races of the African Continent from rickets is probably due to their lack of body covering "despite their monotonous diets."

Sun-baths for children and also for adults are now

considered very beneficial and as long as chills are avoided there seems to be no need to keep children's bodies always covered with clothing. Long clothes for babies are a relic of barbarism and universally condemned by medical men. Much money could be saved and much anxiety prevented if children in the Tropics were put on short clothes at birth and young mothers should be brave enough to defy convention and refuse to make their infants unhappy by swathing them in long garments during the first three or four months of life, when they are seldom taken out in the open.

Children's bed-clothes should be light, warm. Boots or shoes should not be worn until the child begins to crawl about i. e. till the 9th or 10th month. To cramp the feet with shoes before this time is both unnecessary and harmful. Baby's heads should not be wrapped up except in the most severe weather; the adage "keep the head cool" can be literally applied even to infants. As they grow up light loose fitting caps or hats should be used. Sunshine and fresh air are essential for vigorous growth of hair, and this "cheap but invaluable" hair tonic should not be denied to children.

Luckily the present fashions of dress allow much more play of sunlight and air on bodies than used to happen and there is no doubt that the better health of present girls and women is partly due to this.

The best way to develop a graceful figure is, therefore, to indulge freely in open-air sports. This fact is now being recognised by School Authorities in general. Some of them, however, are apt to go to extremes in this direction.

In short, the clothing should be always easy fitting and well ventilated so as to help evaporation of perspiration and thereby keep the body cool. In the absence of proper ventilation the air in contact with the skin becomes saturated with watery vapour derived from the sweat and evaporation gradually becomes less and less. If the clothes are light, permeable and loose-fitting the saturated air is easily dislodged by fresh and drier air and thus the coolness of the skin is maintained.

Certain Aniline Colours, which are often used in dyeing

childrens' clothing like wool under-clothing and socks are in the presence of sweat easily absorbed into the system producing poisonous symptoms like fainting, fever and vomiting, which silly mothers ascribe to "evil eyes" cast on their "lovely-looking" children. We have personally known several instances of young babes having thus suffered by being clothed or sometimes over-clothed with dyed flannels and socks especially during festive gathering and in hot weather.

4. Exercise

The normal healthy child "who feels his life in every limb" desires to exercise his body, to run, jump and play using his growing muscles and working off some of his exuberant energy. This is good and is inspired by Nature, for muscular exercise is absolutely necessary if the child is to be well-developed and strong. Judicious exercise, we have seen, oxygenates the blood and strengthens every muscle and organ of the body. Delicate and enervated children—poor victims of heredity—may have to be coaxed or persuaded to take exercise, but the normal child needs no such inducements. Exercise especially in the open air is one of the necessities of the young if they are to keep in good health and "tone," and grow up to be sturdy men and women fit to be the fathers and mothers of the succeeding generation; it is important however, that the growing boy or girl should not be overstrained by the exercise. We have now in schools, cricket, football and hockey, which are excellent pastimes exercising all parts of the body and hardening the muscles. Power of vigilance and agility of the mind and body are also developed thereby. Badminton too is another advisable form of exercise for both boys and girls. Myopic boys are precluded from taking part in ball-games, but they can indulge in walking, running and other similar sports in which it is not necessary for hand and eyes to be in complete co-ordination as in games where it is required to hit a rapidly moving ball with bat or racket.

Rowing is another fine and healthly exercise, but it is apt to leave an over-strained heart. It is better suited for youths than for little boys.

The exercise which girls may take and the games in which they may indulge should be adapted to their physique and they are not physiologically fitted to compete with boys in athletics being less muscular, having smaller heart and less lung capacity han boys. Hence severe competition among girls should be discouraged as much as possible, for the reason that a girl has more sensitive nervous organisation than a boy and is therefore more susceptible to strain; and competition brings about a state of nervous tension, which is undesirable and tends to upset the whole organism especially at the time of approaching puberty. Team work rather than individual effort is therefore, best suited to the feminine physique and temperament, such as hockey rather than sprinting (running short distance) or single tennis.

5. Sleep

A very young baby ought to sleep and generally does sleep most of his time and the first 3 or 4 weeks after birth is spent by perfectly healthy children in sleeping between feeds. Children of from 2 to 3 years old or bigger should always have a sleep-period of an hour or two during the hottest part of the day, that is, between 2 and 3 P. M., which we have seen is necessary for both the body and the mind, and if they are habituated to this sleep-period from the early days they will go off to sleep quite obediently by force of habit. When the child grows a little older, however, he might become so interested in play or pastime of any sort that he might resist when the time comes for the nap. Yet he must be made to lie down in a darkened room for the accustomed time and he is sure to go to sleep in 5 or 10 minutes' time.

Children of school-going age do not require so much sleep as the very little ones, but all the same they should go to bed early and should have atleast 8 hours' sleep at night. This is quite a necessity as school days are strenuous days for the growing boy and girl, and if enough sleep and rest are not taken the seeds of nervous disease may be sown. Much depends upon proper training from early childhood, and a child that has been well trained will go to sleep naturally on being put to bed, in fact, the

very sight of the bed will "suggest" sleep to him.

Insomnia or sleeplessness is seldom met with in healthy suckling babies as a rule, unless the mother is given to taking a lot of coffee several times in the day. In older children, however, of the school-going age over-study or undue mental excitement may sometimes induce it. Children reading hard before an examination will often complain of sleeplessness. There is mentioned a story of a super-intelligent child, who has since become a famous Writer of Novels. Admonished by her Nurse to "go to sleep like a good girl" she replied, "I can't Nannie, I can't make my mind lie down." This is the state of mind often found in clever children with an active brain.

The remedies for sleeplessness in children are much the same as for older persons, except that narcotics (like opium and its preparations) should not be given to induce sleep. All "soothing" syrups do contain opium in some form or other and are usually given by nursing mothers to young babies to "quiet" them. In many cases symptoms of opium poisoning result and the baby may "sleep a sleep that knows no waking."

Sometimes sleeplessnes is caused by an empty stomach. This can easily be remedied. A hot drink of milk or cocoa (but not coffee or tea, as these by themselves keep off sleep especially if taken at night or late in the evening) with a biscuit or piece of bread or fruit will induce a feeling of comfort and will tend to draw the blood away from the brain into the stomach.

Cold feet are often the cause of sleeplessness and a hot water bottle wrapped up in a thin cloth and applied to the feet will cure the distressing condition of sleeplessness. It is astonishing how many children suffer from coldness of the extremities in the cold climates. A brisk game before bed time causing the blood to circulate and inducing a healthy fatigue is one of the best remedies for insomnia not only in children but in adults too. But care should be taken that the game is not played soon after the night meal.

A child who is restless or wakeful at night probably has indigestion and worms and this must be remedied by changing the food or giving a mild aperient, preferably with a worm powder.

A full stomach just before going to bed will sometimes give indigestion, so the hour of supper and of bed time should be changed. While going to bed on a perfectly empty stomach may cause insomnia, as we saw, an overloaded stomach on the other hand may give a disturbed night full of nightmares, and the happy medium, therefore must be found. Asthmatic children or even asthmatic adults should not be allowed to go to bed till atleast four hours have elapsed since the evening meal, as a full stomach on lying down is sure to start an attack of asthma.

A warm room and a well ventilated one is as essential to a quiet night's repose so that the child wakes bright, refreshed and eager the next morning for the day's work.

Sometimes a highly strung and imaginative child will be kept awake by having heard some frightful story or read some exciting book of adventure just about bed-time. A wise and tactful parent can easily soothe the excited little mind with a few words and the little one reassured and happy will fall asleep immediately. It is good too for a mother to sleep about an hour in the afternoons when the children have had their food and have gone back to school. Otherwise in the evening she may suffer from irritated nerves and become cross and snappish with the children causing them some unmerited unhappiness.

6. Habit of breathing through the Nose

(See under Mouth-breathing Page 13).

7. The Nervous-child and his Care

We have mentioned under Hygiene of Pregnancy that a calm and happy mind free from worry and emotion is an important requisite of the expectant mother who desires to bring into the world a healthy and happy baby; and have seen that the nervous-child has generally a family history of nervous instability, and that in all such cases either or both the parents are neurotic. Such a child has naturally to start life suffering from a pitiable handicap and his state is not likely to improve by home-influences if the mother happens to be neurotic too. Nervous women are apt to be intensely irritable and given to scolding or nagging,.

the irritation sometimes taking the shape of out-bursts of abuse; often these out-bursts are directed towards the innocent child whether his be the fault or not. He is cowed and frightened, or sullen and resentful according to his temperament. The harm that is done to the child in this manner is incalculable. Children have as a rule a very keen sense of justice, sometimes keener than that of adults, and to be blamed and found fault with for no apparent fault of theirs instils bitter feelings in them, which affects their already unstable nerves. Nervous children, it must be said, are abnormally sensitive and are deeply affected by incidents that a normal child would not take notice of or would easily forget; they quickly resent injustice and have a tendency to brood for years over slight grievances.

"Nervous mothers are apt to be unreasonable and unjust" says Webb Johnson, "and the lot of a nervous child in the charge of a nervous mother is indeed pitiable. In such cases life-long nervous instability has been the result of such an association, and the memory of cruelty and unmerited punishment may be carried till his death. There are sensitive, high-strung men and women in the world who are now middle-aged but have never yet forgotten a long continued course of injustice suffered in childhood."

Another curse of the nervous child, continues Webb Johnson is that he is apt to suffer in silence. While the normal child vigorously and loudly protests against injustice, the nervous one broods over it in silence without saying a word, and this lays the foundation of obsessions and fixed ideas. Once let a sensitive child realise that he is the innocent victim of deliberate injustice, and his nature may be "spoiled for life," not to mention the unmerited suffering which he undergoes and always in "stony silence." This reticence is frequently called sulkiness by stupid and ignorant mothers.

Another affliction of a nervous child is that he is often abundantly imaginative and suffers from "terrors" especially at night. Instances are not uncommon where young children or even children of older growth are usually frightened even at the sight of common objects, which they fancy to be really dreadful,

and nervous children are more often beset with such terrors especially at night. The night-time solitude and the dark are "hell" to them, and parents cannot realise what life-long misery and harm they are doing when they leave the tender children alone to go to sleep in the dark. The feeling about for a friendly arm, the hoping for a familiar voice when they wake screaming from fright and find none to soothe them—What a terrible shaking it is to their poor nerves! To keep them up till midnight through light and the unwholesome hours as they are called, would, one can understand from a medical point of view prove the better caution. Terror of the solitude and darkness of the bed-chamber is very "real" to children of a nervous temperament, and a night-lamp should always be kept in the room. It should also be gently impressed upon them that their parents and friends are not far away, and the door may be left open that friendly voices and movements may reach their listening ears.

Silence in itself is terrifying to some children and they long for a familiar footstep or voice to break the dreadful (dreadful to them) stillness of the bedroom. It is not necessary for children to hear terrifying stories or see gruesome pictures to be frightened of the dark, but many a time in their own "thick-coming" fancies they start at imaginary shapes. Some parents are apt to laugh at the child who has nervous fears of darkness and solitude. This implies a complete lack of heart or sense on the part of the mothers. A nervous child must be treated with utmost gentleness and lovingly soothed into tranquility. There are people so fatuously stupid as to believe that this kind of treatment "only encourages the child in his nonsense". They do not, however, comprehend that those terrors which appear "nonsense" to the grown-up are very real indeed to the child. Such people are totally unfit to be in charge of children.

Others who ought never to be allowed near a child, are those wicked women—men are not guilty of this kind of fiendishness—who love to terrify children with tales of goblins said to be lurking in the dark, waiting to seize and carry michievous children, and similar fictions.

"I will give you to the Policeman" is a favourite threat of those in-human creatures. This terrifies the child and instils into him an unreasonable fear of the "guardian of the peace," which may have serious consequences. A child should be taught to look upon the Policeman as his guardian and protector so that if he should be lost in a crowd or separated from his parents, he could turn to the nearest Policeman at once for help and guidance.

There are too many instances of poor little children becoming mentally deficient through fear engendered by threats of cruel and ignorant mothers or nurses. Instances are not uncommon where children were left in the "dark cellar" as punishment for ill-behaviour or for petty faults, and the shock was often so great that they actually became deaf and dumb, and in a few instances even death has ensued.

Fear is the greatest disease of modern civilisation, "the great reservoir of human unhappiness" as Sir Herbert Barker puts it, and the tragedy of it lies in the fact that fear is preventable. There was an oldman who when he came to die sighed: "I have had a great many troubles in my life"; he then paused and added: "But most of them never happened"(See page485). Fear often lies buried deep down in the child's mind for years. During the Great War a medical officer working in a forward dressing station was in the habit of dashing into the open whenever heavy shelling began; he was ordered to take cover, but each time the shells came over, out he rushed. It was obvious that under shell-fire the dug-out dressing station possessed more terrors for him than the open. He was sent to the base-hospital and subjected to psycho-analysis. It was found out that as a small boy he had been imprisoned in a dark cellar with a ferocious dog, which had attacked him. The manner in which this "buried" fear was acting upon his mind having been explained to him he returned to duty—"cured".

There are many physical causes of night terrors in children such as overeating, too much of bedding and over-excitement; worms, enlarged tonsils and adenoids may be the exciting causes.

Nervousness in a child may show itself in various ways—such as, stammering especially when excited, twitchings of the

face and limbs or even choreic movements (St. Vitus' Dance), sudden aversion for particular articles of food, sudden aversion to particular person or place etc.

Unreadiness to answer or looking vacantly at the speaker when addressed, or becoming tongue-tied as it were when spoken to suddenly or unexpectedly, are very common conditions in nervous children; generally these are put down to stupidity; but on the contrary the nervous child may be abnormally quick and intelligent and in fact is almost invariably so. Scolding and beating are the worst possible forms of treatment for a child who is temperamentally nervous. Such a treatment only intensifies the evil and breeds resentment, as a child feels injustice keenly, and to be smacked and scolded for things which he cannot help seems to him the very acme of unfairness. Foolish parents forfeit the respect and esteem of their children when they fall unto unfairness—of all things most resented by the child-mind.

Nervous children need love, gentleness and understanding, and the greatest of these—understanding. A child loves and is grateful to those who take the trouble to understand him, and proportionately dislikes those who are too impatient to try to comprehend him. Ignorant and brutal parents assume that because a child is small and helpless his feelings do not matter; it is only grown up people, they consider, who are entitled to have their feelings properly studied or understood. This gives rise to much cruelty. "Evil is wrought by want of thought as well as want of heart" is as true now as when it was first written, and many people are extremely careless where children are concerned. It is a common mistake to think that one can say anything to a child, for they do not consider the fact that a child is a very real person with his own very real thoughts and feelngs and is therefore, as much entitled to respect as an adult is.

The tyrannical parent who exerts too much authority is a great hindrance to the proper development of the nervous child, and the little child becomes cowed and broken spirited This is not favourable to the growth of self-respect and the child starts life when he goes out into the world with an obsession of in-

feriority—which seriourly hinders his progress. The nervous child should never be oppressed or bullied, but rather encouraged to believe in himself and his own powers. A world of praise or encouragement, a mental or moral "pat" on the back is what the nervous-child requires. This instils or increases self-confidence--a quality which is always sadly wanting in the child, who is neurotic. The boy who is self-confident and self-respecting will naturally go further than the boy whose natural talents are obscured by timidity and self-distrust.

A case is mentioned in which a boy of brilliant ability, combined with close attention and a desire to do his work to the best of his powers, failed to attain the success which was his aim because of early discouragement in the way of home influence. His parents held the old-fashioned opinion that children should be "kept down." They were to be 'seen and not heard,' and every effort to express their own individuality sharply checked. They were, in short, to be treated as beings of a different species from and infinitely inferior to, the adults who surrounded them. Holding these opinions, the parents subjected their son—a nervous, excitable, high-strung boy—to a course of systematic bullying, which took the form of ridicule and sarcasm. The result was that when the time came for him to go out into the world and earn his own living he was handicapped by an acute sense of inferiority and lack of self-confidence. The consequence was the retarding of a career which might have been brilliant. It was not till years had elapsed that he was able to rid himself of that "inferiority complex" which had hampered him in early life, and endeavour to take his rightful place in the world.

The nervous child should therefore be treated with the utmost kindness and sympathy, but not coddled or over-indulged. This "softens" the fibre and is exactly the way of unfitting the child to take his proper place in this world.

Apart from details of daily routine everything should be done, says an Educational authority, to avoid making school a place of mental torture and physical discomfort for nervous children. Life in school should be made as sprightly and homely as possible so that the difficulties of adaptation to the school

environment, which so constantly trouble the neurasthenic child might be minimised. It really comes to this then, that where a child is nervous or exhibits signs of brain-instability the best solution of the problem will be to withdraw the child from the "rough and tumble" of ordinary school-life

On the other hand the dangers of fixing the nervous habit by coddling too much at home must certainly be avoided. Given a fair chance and if properly guided a nervous child will often develop into a highly successful man or woman; because each child starts life with an inherent personality that will ultimately make good if properly fostered and rightly guided. Here we touch upon matters of real national importance. When nursery and school life are based upon true principles of mental and physical hygiene the nervous tendencies of child-life wiil far more often be prevented from developing into the psychoneuroses of adult-liie, and **No training in after-life can provide the reserve of nerve energy that can be built up during school-days by reasonable attention to nature's laws and needs.**

Great is therefore the responsibility on those parents and teachers who have the charge of nervous children. Many a life-tragedy has come about by the unsympathetic handling of nervous children setting up emotional instability and a constant state of irritation and mental distress. Want of tact, want of understanding, want of sympathy and kindness on the parl of parents have often been the causes of a mark being left on a child which has remained through life. "The youth of a nation are the trustees of posterity" says Beaconsfield, and it behoves us to treat those trustees with proper respect and also with proper understanding of their peculiar and individual psychology.

A nervous child should have at least 10 hours' sleep a night and nine hours' sleep is not too much for a growing boy or girl, inclined to be neurotic. There is no, however, hard and fast rule regarding sleep and the reader is referred to under "sleep."

As to the diet of a nervous child attention should be paid to his likes and dislikes. It is cruelty to tell him that the food set before him is "very nice" when it is something which he cannot

bear. Another stupid remark is: "you would eat it fast enough if you were hungry." This remark will apply alright to a perfectly healthy child, but a nervous child would rather go hungry than eat anything he disliked. Now, for the little rapidly growing bodies to be deprived of proper nourishment is a serious matter, and may sow the seeds of disease. Hence it is necessary we study the tastes of the nervous child and not to try to force upon him things which he does not care for. All of us have likes and dislikes, and so do children.

The stupid tendency on the part of parents and nurses in charge to compel the child to eat up everything given to him causes him to gobble up the unwanted food simply in order to get rid of it. This means 'bolting' and imperfectly masticated food, which lies like a "lump of lead" in the little stomach causing endless stomach troubles, such as colic, vomiting. diarrhoea, fever etc.

The child should be allowed to leave whatever he does not want and he should not be told a word about "wicked waste." The most wasteful way of using food is to force it down the gullet of a child who revolts against it. This causes the child acute discomfort and at the same time does nobody any earthly good. On the other hand a child should not be served too large a 'helping,' it is far better to begin with a small quantity in his plate, and if he asks for more let him have a "second helping."

Among the dirty and dangerous habits which children are apt to contract even from babyhood are:

(1) **Thumb-sucking.** This habit is very common in babies and is derived from the instinct of sucking the breast. It is later followed by the practice of conveying everything to the mouth the result being to create oral deformities and danger of carrying infection of disease into the system through dust and dirt. A similar result, we have said, is also produced by the use of baby soothers or baby comforters.

(2) **Masturbation.** No baby or child is free from the danger of contracting the habit of masturbation, which in the young is often taught him by an unscrupulous nurse. These cases are very difficult to cure, but can be prevented by proper care

in time; but as the habit is often due to rough diapers or ill-itting under-clothes, a tight foreskin and irritation of the anus by thread-worms or a highly acid urine etc. the removal of these causes and the use of sedatives will be useful, and some cases may require mechanical restraint of some form.

(3) **"Wetting the bed"** is one of the minor neuroses of childhood and is caused by a soft bed, reflex irritation of the anus by threadworms, constipation, distention of the bladder, a tight foreskin of the penis, adenoids, etc. The treatment is a sedative bland diet, little fluid at night, emptying the bladder before going to bed and "suggestion" every night by the parents that the child will not pass urine in bed any more. Circumcision, removal of the tonsils and adenoids often effect a cure.

(4) **Night terrors of fright.** Most due to the child having been told in the day time or night frightful stories of ghosts, murders etc. In this connection the question arises 'should the child be told fairy tales? An authority interested in this question advises: The ordinary fairy-tale should be swept from the nursery; here the child does nothing but identify himself or herself with the hero or heroine in the most impossible of situations of a purely phantastic type.

There is plenty of scope for giving a growing child interest in stories such as from the Fairy land of Science or from lives of famous persons living or dead; all of which if properly selected and cleared of unnecessary or exciting episodes will assist the child's directive thought, for they are facts in which the child will never have his faith shaken.

A child's imagination needs no encouragement – rather it should be curbed and trained, for, the early life of a child is lived almost entirely in the imagination

As the child advances in years, education and environment gradually convince him of the unreality of his phantastic thoughts and induce him to think in terms of "facts," and what is more important still, to adjust himself to these facts. In other words, he must develop what is known as "directive thinking" which is controlled thought based upon facts in their true perspective. As Bonsfield says "Directive thinking is thus obviously controlled

thinking requiring an effort of attention and concentration as opposed to phantasy-thinking, which knows but little control save hat of desire, and little effort or concentration."

8. The Training of Children

Childhood is the time for training in the use of their intelligence as habits of living are then formed and habits of feeling engendered. It is therefore aptly termed, "the golden period of life." Children who are properly reared by understanding parents, who are taught to face reality, to adjust to situations as they find them, to accept without protest "the pleasure-pain colouring of life," to learn that failure is only a normal part of life, – such children seldom turn out neurotics when they grow up. So also children who are taught self-discipline and who have inculcated in them the sense of good taste and sportsmanship.

Parents should consider that though the child is their own a life has been entrusted to their care, which they should influence in such a manner that the individual grows up into a useful and happy person in so far as the existing environments and the inherent nature of the child will permit of such development.

Children must be given a feeling of security, for this end it is necessary that there should be no friction between the parents themselves; and the children should not be allowed to become aware of financial or other forms of insecurity which might trouble the parents.

Children ought to be allowed a considerable freedom and initiative in order that they may develop their own latent pow(rs; they must be allowed to take reasonable risks. "It is better to risk a child's life than to endanger his spirits."

Parents should live such a life as will furnish an ideal for the child to copy and to understand what are the desirable traits in man's character. In other words, the parents are the child's ideal, their actions will speak louder than their words and will have better influence in the process of training,

Parents should maintain a friendly relationship with their children, try to meet them on a youthful level, comprehend their

reactions and exert their influence by virtue of friendship and respect rather than by employing the powers of a dictator.

The child must be taught self-discipline. This is far more important than any discipline which the parents may impose. Arbitrary discipline is the resort of a lazy, frequently stupid and often selfish adult. It will produce results which are only partially satisfactory and will last only as long as the child is too young and inexperienced to find ways of evading such an arbitrary and often unreasonable type of discipline.

Punishment has at times to be resorted to. It should be accomplished in a fair unemotional and kindly manner. It is doubtful if corporal punishment is ever justifiable. If so it should be the last resort as it indicates want of proper training in the past and as a rule does more harm than good. There are doubtless a few instances when with very young children it has to be employed.

Every effort should be made to avoid difficult situations. Minor errors should be over-looked, the parent giving attention to the principles involved rather than to the specific situation. However, when a serious situation does arise in which the question of discipline is involved it is for the best interests of the child that the parent see the situation through fairly, justly and without unreasonable compromise.

Persistent scolding of children or finding faults with them—nagging as it is called—is never justifiable and is always a bad technic of training children.

Children must not be spoiled. Parents are apt to give their children whatever they ask for and also to save them all possible discomfort. Such children, (who are showered with the material things of the world) do not learn that after they have grown up they will have to "pay a price" for what they get. It is not best for children to be brought up in so protected an environment that they do not experience discomfort. Later on in life they will have to handle many uncomfortable situations and it is best that they learn to do this while they are young, secure in their parents' protection and with the help which their parents can give them.

Parents should not allow their children to become too emotionally dependent on them. Children who are emotionally strongly attached to their parents have great difficulty in growing up. They remain childish in their reactions, and later in life are both dependent and demanding. They make poor husbands or dissatisfied wives, and in general as they grow older they find adaptation increasingly difficult. This does not mean that children cannot love their parents, nor parents show affection for the children, but it is important that parents not fondle their children too much, which unfortunately they commonly do. This is particularly apt to occur if the parents are not well-adjusted to one another and idealise their affections in their children.

Children must be taught good sportsmanship; if necessary the parents must learn it themselves. They must be taught to love and respect other people, to be tolerant and to look for another's good points rather than bad traits.

They must be taught to work. The younger generation is growing up with very little practical experience in working, with the result that when they are thrown out on their resources they not only have no knowledge of how to work, but are unreasonably afraid of failure.

Parents who play with their children have much more influence over them than those who do not. Children should under no circumstances be relegated to "ayahs" or governesses; and supposing that relegation is necessary parents should give them as much of their time as they possibly can both for their own sake and for the sake of the children.

Parents should keep in constant touch with their children teachers, as they are able to see qualities in the children which parents are perhaps not familiar with. By familiarising with the work of the child in school the parents will stimulate the child's interests, broaden their own point of view and be able to make suggestions to the teacher which will be of great value towards the child's training.

Parents should secure their children company and association of as many playmates as possible and try to make the

home a place where children would like to congregate. If there is only one child in the house it is advisable to allow him the company of other children of the same age as far as possible, as often children who have no brothers or sisters are markedly handicapped in their adjustment to life.

One should do everything possible to broaden the child's knowledge of the world. This can be accomplished through reading, conversation or best of all through travel.

When they grow older, children should be sent away from home to boarding schools, to camp or to visit their friends. Don't be afraid they might pick up bad habits, perhaps they might, but they had better be subjected to these influences during the period they are in touch with their parents than later on.

Parents should not be too upset by the minor difficulties of their children; they should remember that they (children) pass through phases during which they are at times difficult to control. Luckily those phases are short in duration. Be therefore patient with children and help them to handle their difficulties in adjustment.

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It may be seen from the above résumé that both constitutional and environmental factors play their part in causing the difficulties of child-rearing, and it may be stated as an axiom that one of the most frequent causes of serious problems of adjustment occurring in children is the absence of a normal home-life. This absence is the result of either the parents being separated, or dead, or the friction between parents being so great as to practically constitute a broken home.

It is of interest to note that children reared by neurotic parents are very apt to be neurotic themselves. This is particularly true if either or both of the parents to whom the children may be closely attached are neurotic also.

Most of the symptoms of neuroses we meet with in nervous children are due to the ways in which they have been reared by their parents and the influences to which they have been subjected in their homes. Hence it is possible that these symptoms can be cured either by removing the children from the

environment where the trouble occurred or by correcting the situation in the home.

The majority of children have some nervous difficulties or other when they grow up and much depends upon how they were trained by their parents or teachers in childhood.

The question has often been asked if it is advisable that children be given knowledge about sex matters at all before any specific time or age. It may be answered that there is no reason why they should not be given facts about sex matters in a straight forward manner even before any specific age is reached. In fact the whole matter should from the child's earliest years be so frankly, freely and completely discussed in the life of the home that the child understands these biological facts as naturally and as fully as he comprehends the other every-day facts of living.

On the other hand if the so-called sex matters are kept away from the child his suspicions grow and he becomes more inquisitive and tries by all means possible to get the information through servants or ayahs, who are apt to mislead him by false information or possibly by direct reference to the sex organ.

We have personally known shocking instances where young children have been spoiled by unprincipled ayahs, and innocent boys of 9 or 10 given venereal infection.

IX. Common Affections of Childhood

1. **Measles.** This is an acute infectious fever characterised by catarrh of the respiratory tract and a red eruption, and is due to a filtrable virus. The disease is highly infectious and is readily transmitted even before the symptoms are distinctive. It usually spreads from person to person by the breath and nasal secretions. One child in school or boarding house suffering from the disease gives the infection to others. The disease is considered endemic in most civilised countries; and as it is so wide spread and so infectious it is generally acquired in childhood.

The susceptibility diminishes in later childhood, but the disease has been found to occur a second time even after the 15th or 20th year. When measles has attacked virgin soil in recent times as among the Fiji and Faroe Islands it has proved a

very formidable epidemic; the reason, of course, is that when the disease has prevailed in a country for several generations a certain amount of natural immunity is developed and inherited. Any existing catarrh or cold of the nose or the respiratory tract easily predisposes to measles

The incubation period is about 10 days. The onset is abrupt and is characterised by shivering, sneezing, redness of the eyes, running from the nose, heaviness of the head, a hoarse cough and sometimes especially in the very young, diarrhoea. The eruption appears on the 4th day; and both the rash and the fever reach their maximum about 36 hours later. The rash first appears on the face and behind the ears; and soon extends on the chest and the back and the limbs. It takes the form of small red elevated spots, which increase in size and run together to form irregular patches. The rash generally fades by the 7th day leaving a brownish staining which may persist for some days longer.

Before the skin eruption appears there may frequently be seen on the inside of the cheeks and lips small red spots with pale blue centres—Koplick's Spots as they are called—which are diagnostic of the disease. This importance is attached to these spots as they may be present one to three days before the characteristic rash appears.

Bronchitis and Bronchopneumonia are the commonest complications; but there may be sore eyes, ulceration of the cornea and suppuration in the ears.

Tuberculosis and whooping cough are rare sequelae (after effects).

Prevention: The child should be withdrawn from the school at once, and kept in bed in a warm well ventilated room and isolated from other children. The diet should be simple and given warm. During convalescence care must be taken to prevent a chill. Isolation must be continued for 3 weeks after the appearance of the rash, and for a longer period if the nasal catarrh and bronchitis have not passed away by that time. The period of quarantine after exposure to the risk of infection should be atleast 16 days. The spread of disease on a large scale can

be controlled by prompt notification to the sanitary authority by the school master of any case occurring in the homes of the school boys.

2. **Diphtheria.** *(Membranous croup)* An acute infectious disease characterised by a membranous inflammation of the faucial or laryngeal mucous membrane, and often causing great prostration, degenerative changes in the heart, the kidneys and the peripheral nerves. The specific microbe—the Klebs-Loffler bacillus—is present in the memranous exudation but does not invade the blood-stream. Hence the symptoms of the disease are due to absorption of the specific toxin. The bacillus is easily ejected from a diphtheritic throat by coughing or sneezing and may thus reach a healthy person; or the infection can be conveyed from person to person by direct contact or by medium of spoons or pencils from one school-child to another. Children or adults who have been in contact with infected individuals (and who are therefore "contacts" may harbour the microbe in their throat or nose without themselves showing signs of the disease, but in such cases the organisms are usually nonvirulent.

Diphtheria is specially apt to attack children under 10 years of age, and especially in those who had a recent attack of measles or sore throat or scarlet fever.

The incubation period is usually from 2 to 4 days, and may even be 36 hours to 7 days.

Prevention is best done by Isolation and disinfection—and production of immunity by injection of anti-diphtheritic serum. The infective period is from 4 to 6 weeks and has practically to be spent by the patient in bed only on account of the extremely grave condition of the heart and kidneys. The persistence of the "Carrier" stage is usually due to some local infection such as chronic enlargement of the tonsils, adenoids, sore-throat and nasal disease.

3. **Whooping-cough.** This is an acute specific disease characterised by catarrh of the respiratory tract and by paroxysms or fits of coughing which terminate with a long inspiration, which gives rise to the "whoop."

The specific microbe is the Bacillus pertussis, which can be

cultivated from the sputum even in the early weeks of the cough.

It is communicated chiefly through the sputum but may perhaps be communicated through the breath. The majority of cases occur in children within the first ten years of life; epidemics usually prevail in the colder months of the year, and whooping cough and measles are supposed to predispose to one another. Young rickety and otherwise delicate children suffer most. Domesticated dogs are sometimes affected with the disease and they may at times transmit it to children. The incubation period is variable but may be said to be about ten days.

Apart from complications the out-look is favourable, but when complications set in the disease may end in death.

Prevention. The affected child should not be allowed to return to school for atleast six weeks after the commencement of the "whooping" stage of the cough. Earlier in the disease there being no characteristic signs and symptoms the disease is difficult of diagnosis, and the young patient being able to walk about throughout the course of the disease it is difficult to isolate him from other children in the household.

The period of quarantine after exposure to the risk of infection is generally extended to 3 weeks.

4. **Infantile Biliary Cirrhosis** (*Infantile-liver*). This is a very common disease of children in India and is found to be more prevalent among Hindu children than Mahmadan and Christian children. The disease occurs principally in children under 1 year, rarely attacking those over 3 years. As a rule it begins during dentition i. e. about the 7th or 8th month running a fatal course in 3 to 8 months. Instead of lasting several months its progress may be more rapid and terminate in death even in 2 or 4 weeks. The disease seems to be more common in places where rice is the staple food, such as Madras and Bengal presidencies and U. P. and is more prevalent in rural parts than in towns.

Cause. The cause is unknown, but neither alcohol, syphilis nor malaria (which generally produce a similar condition of cirrhosis of the liver in the adult) has anything to do with it. The children of the well-to-do are relatively more frequently attacked

than those of the poor. It has also been observed that the disease tends to run in families, child after child of the same parents succumbing within a year or two of birth. Green Armytage believes that the true aetiology is in the deficiency of vitamins in the mother's diet during pregnancy and lactation, thus depressing the mammary secretion and the endocrine system of the foetus; over-feeding of the child when born and insufficient feeding of milch-animals. Megaw believes that the disease (cirrhosis of the liver) is the direct sequel of bacillary dysentery in children. Aykroid believes that vit. B (complex) deficiency is the cause of the disease, both in the diet of the infant after birth and the mother during pregnancy, and that the condition is curable by the administration of fresh-milk, yeast, fruits and Cod Liver Oil, as the deficiency of vit. B is associated with vit. D deficiency and deficiency in Calcium and Phosphorus assimilation. The disease is thus often associated with rickets, which is often present but may not be marked.

Signs and Symptoms. Commencing gradually the characteristic enlargement of the liver may have made considerable progress before the disease is suspected. Nausea, occasional vomiting, sallowness, feverishness and languor call attention to the child's condition. On examination the liver is found to be enlarged sometimes enormously extending perhaps to the navel and even lower. The surface of the organ is loose, the swollen organ feeling hard and resistent. The spleen also may be enlarged. Fever of a low type sets in, the sallowness deepens into profound jaundice. The stools are clayish, urine dark with bile and there may be a terminal ascitis (dropsy into the abdomen) with puffiness of the feet and hands. The skin may be bronzed and sooner or later death results from cholaemia (bile in the blood).

Preventive measures. Proper feeding of the mother during pregnancy and lactation. When weaning occurs the child should be fed on good cow's milk. No proprietory foods are good, sweets should be avoided. Fresh fruit juice and Cod Liver Oil should be given daily and from a very early period to the child even though breast-fed.

General advice to Parents

It may now become evident to the reader that the care of children should preferably commence before they are born and that sufficient care of the mother herself during the state of pregnancy will do much to ensure a halthy progeny. We have already studied how heredity may affect the future race. Parents healthy in body and in mind will produce healthy and sound offspring. Drunkards, moral degenerates, neurotics, epileptics—all produce unsound progeny handicapped in life to start with by the qualities of their parents. It is important, therefore, that the expectant mother should consider the coming child as of the utmost importance and to refrain from excesses of any sort during pregnancy; she should refrain from excess in eating, drinking, sexual excitement and should not give way to mental depression, anger, temper etc. Family quarrels when the woman is near her confinement have been known to have produced a harmful effect on the child in the womb. Such things, however, are unfortunately common still amongst our women. In fact few mothers know how to live properly in the gestation-stage and realise that unhealthy and unsound children are the products of their own carelessness and could be avoided with a proper amount of care and in time.

There are several ailments of children, we have seen, that can be prevented by ordinary care. Rickets, for instance, is a disease due to wrong feeding. Breast feeding or natural feeding is the best preventive of rickets as a large percentage of cases occur in hand-fed children or children fed entirely on artificial foods. Fresh air and sunlight are, next to food, the best preventives against this disease.

Feeding, of course, is all important in the case of children and most of the troubles of infancy and childhood are caused by giving children unsuitable food and too much of it; and most of our children and adults would be twice as well upon half the amount of food they take or are compelled to take by their parents. A very common habit with over-indulgent mothers, both among the rich and the poor, is to give children sweets

chocolates, biscuits and other foods between the principal meals of the day. This practice, it must be noted, interferes with digestion and brings about diarrhoea, vomiting, colic, fever etc. and if continued long may give rise to liver troubles and malnutrition of a serious kind. A child should, however, have plenty of fruits, fresh fruits preferably, as an every day routine article of diet, not as an occasional present for better behaviour.

Children should not be allowed to stuff themselves, a little starvation now and then does no harm whatsoever, but is on the other hand itself a cure for almost all complaints of childhood. They should not be forced to eat when they do not want to eat, for this is the most wasteful and at the same time most harmful method of using food on them when the food does them no good whatever.

Neglect of teeth is fraught with many dangers, defective teeth are usually due to dietetic errors. Children should not be given soft and pappy foods, but given something which the little teeth can tug at, something which will exercise the jaws and gums and develop the muscles of mastication (chewing). The habit of bolting food not only fails to develop the teeth and the jaw but brings about indigestion, diarrhoea etc. Thorough mastication should be taught and insisted upon when the child is able to take solid food.

"Nerves" constitute one of the greatest problems of the present day, and children are just as liable to nerve troubles as adults. Some children are born with neurotic habits inherited from their parents and in some neurosis is brought about in later life by sudden mental shock, disappointment in love and in business, failure to adjust oneself to varying circumstances or to successfully compete in life. Whatever be the cause a nervous child, we have seen, suffers terriblv and in silence, and should be treated with kindness, sympathy and more than anything else, with understanding.

Nervousness can be brought about by bad habits, and that is the reason why children especially at the age of puberty should be carefully watched and guarded. Healthy exercise and hard study both tire the body and occupy the mind. An

idle-mind in an idle body about the time of puberty when the sexual instinct begins to stir in the youth leads to lascivious or lustful thoughts and actions.

Bathing, proper clothing, exercise in open air, life in properly ventilated and lighted rooms—all have their place in the health-programme of children also as in the case of adults, and it is the bounden duty of the parents to attend carefully to these requirements; for the youths of a Nation are the Trustees of Posterity.

Says Dr. Maria Montessori--"The child is the father of the man, because every child makes a man and is a mission sent by God to every home. He is also the teacher of man, because he makes us understand so many errors which we commit socially by the expression of his life."

REFERENCES

In the preparation of this work we have consulted only the latest and most eminent works on the subject and confess that we could not resist the temptation of having in several instances to extract in toto therefrom, so as to preserve the initial beauty of style, force and clearness of expression, accuracy of statement and originality of ideas and observations. We respectfully acknowledge them here and express our regret for any unintentional omission.

Appleton: Practitioner's Library of Medicine and Surgery—
12 volumes, 1933-37.
Medical Research Council: Vitamins Survey.
R. N. Chopra: Tropical Therapeutics 1936.
Hutchison & Mottram: Food and the Principles of Dietetics 1936.
E. B. Tyler: Anthropology.
Lukis & Blackham. Tropical Hygiene.
McNally: Hygiene for India.
Ambalal D. Patel: Indian Agricultural Economics.
Ghosh: Hygiene.
Kamath: Medical Jurisprudence 1938.
Rangachary: Hand book of Botany for India.
Rogers & Megaw: Tropical Medicine.
Manson—Bahr: Tropical Medicine.
Transactions of the Bombay Medical Congress (1909).
Green Armytage: Midwifery in the Tropics.
Winton & Bayliss: Human Physiology.
Samson Wright: Applied Physiology.
Alexis Carrel: Man, the Unknown.
Trine (Ralph Waldo): In Tune with the Infinite.
Emerson (Ralph Waldo): The Conduct of Life.
Emile Coué: Autosuggestion—by Brooks.
McCarrison: Food.
Aykroid: Government of India Health Bulletin No. 23 of 1937.
Cecil Webb-Johnson: Health and Diet.
Do. Do. The Care of the Child.

Brown—Antenatal and Postnatal Care
Steen—Infant Feeding.
Jellet and Madill—Manual of Midwifery.
Current Medical Literature—The Lancet; The British Medical Journal; The Practitioner; Indian Medical Gazette, etc.
Newspapers and Periodicals—The Hindu, The Madras Mail, The Harijan, The Bombay Chronicle.

Explanation of Certain Terms used it the Text

Anaemia: Unhealthy paleness, lack of blood.

Aneurysm: A tumour or swelling containing blood and communicating with the interior of a blood vessel.

Ankylosis: Limb stiffened and bent at an angle.

Arthritis: Inflammation of a joint.

Bovine: Relating to the cow or ox.

Brights' Disease: Inflammation of the kidney.

Bronchitis: Inflammation of the Bronchi of the lungs.

Caesarian Section: Delivery by surgically cutting open the womb. Julius Caesar is so named as he was "cut out of the mother's womb" *a matris utero caesus.*

Delusion: False belief of a thing which does not exist.

Epsom Salts: Magnasium Sulphate.

Gastric: Relating to the stomach.

Gastritis: Inflammatien of the stomach mucous membrane.

Glauber's Salts: Sodium Sulphate.

Haemorhage: Bleeding.

Hemiplegia: One sided paralysis.

Hepatic: Relating to the liver

Illusion: A misinterpretation of an existing fact; a rope, for example, is mistaken for a serpent.

Meninges: The membranes covering the spinal cord and the Brain.

Meningitis: Inflammation of the meninges.

Nasopharynx: Nasal portion of the pharynxr

Nephritis: Inflammation of the kidney.

Obsession: A fixed idea or delusion haunting the mind.

Pericardium: Sac outside the heart.

Pericarditis: Inflammation of the pericardium.

Peritonium: Lining membrane of the abdomen and its organs.

Pessary: A conical mass of a fatty substance containing an active drug like Quinine, morphine etc. meant to be introduced into the vagina or the anus.

Pleura: Covering of the lunq.
Pleurisy: Inflammation of the pleura.
Pneumonia: Inflammation of the lung.
Prophylaxis: Prevention.
Psychoneurosis: Mental weakness or derangement.
Synovial membrane: Membrane lining the inside of joints.
Synovitis: Inflammation of the synovial membrane.
Tubercle: Is an inflammatory new growth depending upon th presence of the tubercle bacillus and capable of induc ing Tuberculosis.

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